



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>



HN 22VL A

KEY TO DAVIES'
UNIVERSITY ARITHMETIC.

NATIONAL SERIES OF STANDARD SCHOOL-BOOKS

COMPRISES STANDARD WORKS

ment of instruction and of every grade. The teacher in want of a book for any pair or class, will always find the best of its kind in our catalogue. No other series even so complete as this. None is so extensive or so judiciously selected. Among so many a standard of merit is maintained, as it is our aim never to permit our imprint upon a worthy book. It is also our plan to make books not for a class or sect, but for the whole objectionable to parties and creeds, while inculcating the great principles of political Christianity, upon which all right-minded persons are agreed. Hence, and from their universal circulation, the name—"National Series." Among the principal volumes are

Watson's Readers—in two distinct series, each complete in itself. *The National Readers*, of full grade, in large, elegant volumes, adequate for every want of the most thorough and highly graded schools. *The Independent Readers*, in smaller volumes, for Common Schools. Low in price, but in no other respect inferior to the companion series. *Spellers* complete to accompany either series.

Davies' Mathematics—*Arithmetic, Algebra, Geometry, Surveying, &c.*—Complete in every branch—The national standard—world-renowned. Millions have been called for, and the sale increases year by year. New volumes are constantly published to take the places of those that are in the least behind the times. *Examine the new Series.*

Barnes' Brief Histories—*The United States History*; and others to follow.—For one term of study. Makes history short by omitting that which is usually forgotten, interesting by charming language and illustrations, and pointed by a system of grouping about the most important events. No dry bones or tedious statistics.

Monteith's Geographies—*Topical, Descriptive, Political, Physical.*—These works are eminently practical, and enjoy a larger circulation than any other series. From a number of volumes not necessarily consecutive, the teacher may select just the book he wants.

Steele's Natural Science—"14 Weeks"—*Books in Philosophy, Chemistry, Astronomy, Geology, &c.*—Brief, intense, popular beyond all precedent; they make science available for Common Schools.

Clark's Diagrammar—The new system for English Grammar, by object lessons and novel analysis. Gradually superseding all others.

Worman's Modern Languages—Complete series in the *German, French, &c.*—Upon a new plan for combining all the advantages offered by preceding authors, with signal new ones.

Searing's Classics—*Virgil's Aeneid, Homer's Iliad, Cicero's Orations*, and others, with Notes, Lexicons, Maps, Illustrations, &c.—The most complete and elegant editions.

BARE MENTION only can be made in this summary of all the other standard texts published by our house, as in

English Language—CLEVELAND's Compendiums of Literature—BOYD's Annotated Authors, Composition, Logic, Criticism, &c.—SMITH's Etymology, from every source of language—DEFINERS, Dictionaries, Writing Spellers, False Orthography, Dictation, Topical Lexicon—NORTHERN's Series of Speakers—ZACHOS' Elocution, &c.

History—MONTEITH's Child's U. S.—MRS. WILLARD's Series; U. S. and Universal—BERARD's England—RICORD's Rome—Summary of Hist., in 103 pages—Bible Hist.—Ecclesiastical Hist.

Pen and Penell.—BEERS' Round-hand Penmanship—Copy-book Cover—National Steel Pens—SMITH & MARTIN's Bookkeeping—CHAPMAN's Drawing Book—Drawing Cards—ALLEN's Map Drawing.

Natural Science—NORTON & PORTER's First Book—PECK's Ganot's Philosophy—PORTER's Chemistry—MCINTYRE's Astronomy—PAGE's Geology—JARVIS' Physiology—WOOD's Botany—CHAMBERS' Zoology—PECK's Mechanics—BARTLETT's College Philosophy.

Important Works also are FUSJOL's French Class Book—DWIGHT's Mythology—HUNTINGTON's Fine Arts—CHAMPLIN's Political Economy—MANFIELD's Government Manual—ALDEN's Ethics—BROOKS' Manual of Devotion—TRACT's School Record, &c.

The Teacher's Library consists of over 30 volumes of strictly professional literature, as PAGE's Theory and Practice—HOLBROOK's Normal Methods—NORTHERN's Teacher's Assistant, &c.

A DESCRIPTION

many more may be obtained by enclosing a letter,

& COMPANY,

1 Publishers,

100 N. 2ND ST. NEW YORK.

737 19th Jan, Feb 10 732
"A Well of English Unfaded."

LITERATURE AND BELLES LETTRES.
PROFESSOR CLEVELAND'S WORKS.

A WHOLE LIBRARY IN FOUR VOLUMES.

COMPENDIUM OF ENGLISH
OF 19th CENT'Y
OF AMERICAN
OF CLASSICAL **LITERATURE.**

One Hundred and Twenty Thousand of these Volumes have been sold,
and they are the acknowledged Standard wherever
this refining study is pursued.

PROF. JAMES R. BOYD'S WORKS.

EMBRACING

*COMPOSITION, LOGIC, LITERATURE, RHETORIC, CRITICISM,
BIOGRAPHY;—POETRY, AND PROSE.*

BOYD'S COMPOSITION AND RHETORIC.

Remarkable for the space and attention given to grammatical principles, to afford a substantial groundwork; also for the admirable treatment of synonyms, figurative language, and the sources of argument and illustration, with notable exercises for preparing the way to poetic composition.

BOYD'S ELEMENTS OF LOGIC.

explains, first, the conditions and processes by which the mind receives ideas, and then unfolds the art of reasoning, with clear directions for the establishment and confirmation of sound judgment. A thoroughly practical treatise, being a systematic and philosophical condensation of all that is known of the subject.

BOYD'S KAMES' CRITICISM.

This standard work, as is well known, treats of the faculty of perception, and the result of its exercise upon the tastes and emotions. It may therefore be termed a Compendium of Aesthetics and Natural Morals; and its use in refining the mind and heart has made it a standard text-book.

BOYD'S ANNOTATED ENGLISH CLASSICS.

*Milton's Paradise Lost.
* Young's Night Thoughts.*

Cowper's Task, Table Talk, &c.

*Thomson's Seasons.
Pollok's Course of Time.
Lord Bacon's Essays.*

In six cheap volumes. The service done to literature, by Prof. Boyd's Annotations upon these standard writers, can with difficulty be estimated. Line by line their expressions and ideas are analyzed and discussed, until the best comprehension of the powerful use of language is obtained by the learner.

KEY
TO
DAVIES'
UNIVERSITY ARITHMETIC,

EMBRACING

**THE ANSWERS, AND A FULL ANALYSIS AND SOLUTION
OF THE DIFFICULT QUESTIONS.**

VALUABLE ONLY TO THOSE WHO LABOR.

A. S. BARNES & COMPANY,
NEW YORK AND CHICAGO.

1874.



KD34.805

ADVERTISEMENT.

THE attention of Teachers is respectfully invited to the **REVISED EDITIONS** of

Davies' Arithmetical Series

FOR SCHOOLS AND ACADEMIES.

1. DAVIES' PRIMARY ARITHMETIC.
 2. DAVIES' INTELLECTUAL ARITHMETIC.
 3. DAVIES' ELEMENTS OF WRITTEN ARITHMETIC.
 4. DAVIES' PRACTICAL ARITHMETIC.
 5. DAVIES' UNIVERSITY ARITHMETIC.
 6. DAVIES' PRACTICAL MATHEMATICS.
-

The above Works, by CHARLES DAVIES, LL. D., Author of a Complete Course of Mathematics, are designed as a full Course of Arithmetical Instruction necessary for the practical duties of business life; and also to prepare the Student for the more advanced series of Mathematics by the same Author.

The following New Editions of *Algebra*, by Professor DAVIES, are commended to the attention of Teachers:

1. DAVIES' NEW ELEMENTARY ALGEBRA, AND KEY.
 2. DAVIES' UNIVERSITY ALGEBRA, AND KEY.
 3. DAVIES' BOURDON'S ALGEBRA, AND KEY.
-
-

Entered according to Act of Congress, in the year one thousand eight hundred and sixty-four,

BY CHARLES DAVIES,

In the Clerk's Office of the District Court of the United States for the Southern District of New York.



P R E F A C E.

It is not yet a settled question whether a Key to a Mathematical work is an aid or a hindrance. The diversity of opinion which exists on this point doubtless arises from the different *uses* to which a Key is applied. A Key should never be used to supersede investigation and labor; but always to turn the former into right channels, and to make the latter more available and effective.

How to study—how to investigate—how to labor—and how to teach, are the great questions; and it is these which a Key should answer.

It is not results alone that give value to a Key; but it is the explanation of methods—the examination of principles applied in the solution of problems, and a general and minute analysis of such questions as contain within themselves the germs of science.

It is also the province of a Key to lessen the *mechanical labor* of Teaching. Amid the various and complicated duties of the school-room, the teacher can scarcely find time

to work out every question on the slate or blackboard. In the Key he not only finds the best forms of analysis, but also the best arrangement of the work to be done; hence, he has a standard to which the work of his pupils should conform. He has only to guard against the danger of permitting his Key to become a *substitute* for a full and thorough investigation on his part, and he will avail himself of the general analysis and the best practical methods, without at all interfering with the independent operations of his own mind.

Great care has been taken to make a full and complete analysis of every question whose solution presents a new principle; and so to construct the analysis as to make that principle most apparent. It is believed that all the important forms of analysis have been given, and that all the classes of practical questions have been considered.

FISHKILL LANDING,

July, 1864.

KEY

TO

UNIVERSITY ARITHMETIC.

ROMAN NOTATION.

(1)	(2)	(3)	(4)	(5)
<i>Ans.</i> XI.	XIV.	XVI.	XVII.	XIX.

(6)	(7)	(8)	(9)
<i>Ans.</i> XXII.	XXVIII.	XXIX.	XXXIII.

(10)	(11)	(12)
<i>Ans.</i> XXXVII.	XXXVIII.	XLIII.

(13)	(14)	(15)	(16)
<i>Ans.</i> XLVII.	XLIX.	LVI.	LVIII.

(17)	(18)	(19)	(20)
<i>Ans.</i> LIX.	LXV.	LXIX.	LXVII.

(21)	(22)	(23)
<i>Ans.</i> LXXV.	LXXVI.	LXXXI

(24)	(25)	(26)	(27)
<i>Ans.</i> LXXXVII.	LXXXIX.	XCIV.	XCV.

	(28)	(29)	(30)	(31)
<i>Ans.</i>	XCVII.	XCIX.	CXV.	DCCL.

	(32)	(33)	(34)	(35)
<i>Ans.</i>	MLX.	MMXL.	DLX.	DCCCCLX.

	(36)	(37)	(38)	(39)
<i>Ans.</i>	DCXC.	ML.	MMMIV.	$\overline{\text{VMIX.}}$

	(40)	(41)	(42)
<i>Ans.</i>	$\overline{\text{IXIX.}}$	DCCCVI.	DCVIII.

	(43)	(44)
<i>Ans.</i>	$\overline{\text{VMMMVI}}$	MMI.

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Ans.</i>	7	80	9000	93	961	7408

	(7)	(8)	(9)	(10)
<i>Ans.</i>	897021	86029430	4328021063	967040932

	(11)	(12)	(13)
<i>Ans.</i>	30430208123	360030702010	5800006000812

	(14)	(15)
<i>Ans.</i>	75605070905008	904000800200720

	(16)	(17)
<i>Ans.</i>	6000900704098020	80510006040900040900

	(18)	(19)
<i>Ans.</i>	6050900001	987654321012345678

(1)	(2)	(3)
<i>Ans.</i> 621	<i>Ans.</i> 5 702	<i>Ans.</i> 8 001
(4)	(5)	(6)
<i>Ans.</i> 10 406	<i>Ans.</i> 65 029	<i>Ans.</i> 40 000 241
(7)	(8)	(9)
<i>Ans.</i> 59 000 310	<i>Ans.</i> 12 111	<i>Ans.</i> 300 001 006
(10)		
<i>Ans.</i> 69 003 000 200		

NUMERATION.

(11)

Ninety-seven. *Ans.*

(12)

Three hundred and twenty-six. *Ans.*

(13)

Three thousand, three hundred and two. *Ans.*

(14)

Sixty-five thousand and forty-two. *Ans.*

(15)

Seven hundred and forty-two thousand, six hundred and four

(16)

Thirty-two millions, forty-five thousand, six hundred and seven

(17)

Ninety millions, four hundred and sixty-four thousand, two hundred and thirteen. *Ans.*

(18)

Forty-seven millions, three hundred sixty-four thousand, two hundred and ninety-one. *Ans.*

(19)

Four billions, thirty-seven millions, nine hundred and two thousand, one hundred and sixty-nine. *Ans.*

(20)

Ninety-one millions, forty-six thousand, three hundred and two.

(21)

Seven hundred eighty-four millions, two hundred thirty-six thousand, seven hundred and four. *Ans.*

(22)

Seven billions, four hundred and three millions, twenty-six thousand, and fifty-four. *Ans.*

(23)

Twenty-one billions, seven hundred and four millions, eighty thousand, four hundred and ninety-five. *Ans.*

(24)

Twenty-one billions, eight hundred ninety-six millions, seven hundred and twenty thousand, four hundred and twenty-one.

(25)

Eight trillions, one hundred and forty billions, two hundred and ninety millions, three hundred and eight thousand and ninety-seven.

(26)

Eight trillions, five hundred and four billions, six hundred and eighty millions, four hundred and sixty-seven thousand, and twenty-three. *Ans.*

(27)

Ninety trillions, four hundred and three billions, forty millions, seven hundred and twenty thousand, one hundred and fifty-six. *Ans.*

(28)

One hundred and seventy-two trillions, three hundred and four billions, seven hundred and thirty-six millions, eight hundred and ninety-three thousand, two hundred and ten. *Ans.*

(29)

Thirty trillions, four hundred and sixty-seven billions, two hundred and fourteen millions, three hundred and two thousand, seven hundred and four. *Ans.*

(30)

One hundred and sixty-seven trillions, three hundred and twenty billions, four hundred and ten millions, three hundred and forty-one thousand, two hundred and four. *Ans.*

(31)

Two quadrillions, one hundred and sixty-four trillions, thirty-two billions, one hundred and eighty-nine millions, seven hundred and sixty-five thousand, four hundred and twenty-one.

(32)

47 000 069 000 465 207

(33)

800 000 000 000 429 006 009

1*

(34)

95 000 000 000 000 089 089 306

(35)

6 000 000 451 065 047 104

(36)

Ans. 999 065 841 411

(1)

2; 7

(2)

7; 3

(3)

1; 7

(6)

 $426 \times 100 = 42600$ cents; $426 \times 100 \times 10 = 426,000$ mills.

(7)

 $36 \times 10 + 8 = 368$ dollars. $368 \times 10 + 6 = 3686$ dimes. $3686 \times 10 = 36860$ cents.

(8)

 $8750 \div 10 = 875$ cents $875 \div 100 = \$8.75$

(9)

 $43 \times 10 + 3 = 433$ dollars. $433 \times 100 = 43300$ cents. $43300 \times 10 + 5 = 433005$ mills. *Ans.*

(10)

 $37 \times 20 + 9 = 749$ s. $749 \times 12 + 8 = 8996$ d.

(11)

 $1569 \div 4 = 392$ d. 1 far.; $392 \div 12 = 32$ s. 8d; $32 \div 20 = £1$ 12s; $£1$ 12s. 8d. 1 far. *Ans.*

(12)

 $7 \times 20 + 14 = 154$ cwt.; $154 \times 4 + 1 = 617$ qr.; $617 \times 25 + 20 = 15445$ lb.;15445 lb. *Ans.*

(13)

 $15445 \div 25 = 617$ qr. 20 lb.; $617 \div 4 = 154$ cwt. 1 qr.; $154 \div 20 = 7$ T. 14 cwt.;*Ans.* 7 T. 14 cwt. 1 qr. 20 lb.

(14)

 $4 \times 12 + 6 = 54$ oz.; $54 \times 20 + 12 = 1092$ pwt.; $1092 \times 24 + 7 = 26215$ gr.;*Ans.* 26215 gr.

(15)

$$704121 \div 24 = 29338 \text{ pwt. 9 gr. ;}$$

$$29338 \div 20 = 1466 \text{ oz. 18 pwt. ;}$$

$$1466 \div 12 = 122 \text{ lb. 2 oz. ;}$$

$$\text{Ans. } 122 \text{ lb. 2 oz. 18 pwt. 9 gr.}$$

(16)

$$5 \times 12 + 1 \frac{3}{4} = 61 \frac{3}{4} ;$$

$$61 \times 8 + 1 \frac{3}{4} = 489 \frac{3}{4} ;$$

$$489 \times 3 + 1 \frac{3}{4} = 1468 \frac{3}{4} ;$$

$$1468 \times 20 + 2 \text{ gr.} = 29362 \text{ gr.}$$

(17)

$$174947 \div 20 = 8747 \text{ } \textcircled{D} \text{ 7 gr. ;}$$

$$8747 \div 3 = 2915 \text{ } \textcircled{D} \text{ 2 } \textcircled{D} ;$$

$$2915 \div 8 = 364 \frac{3}{4} \text{ } \textcircled{D} \text{ 3 } \textcircled{D} ;$$

$$364 \div 12 = 30 \text{ lb } 4 \frac{3}{4} ;$$

$$\text{Ans. } 30 \text{ lb } 4 \frac{3}{4} \text{ } \textcircled{D} \text{ 3 } \textcircled{D} \text{ 7 gr.}$$

(18)

$$6 \times 3 + 2 = 20 \text{ ft.}$$

$$20 \times 12 + 9 = 249 \text{ in. Ans.}$$

(19)

$$5 \times 8 = 40 \text{ fur. ; } 40 \times 40 =$$

$$1600 \text{ rd. ; } 1600 \times 5 \frac{1}{2} = 8800$$

$$\text{yd ; } 8800 \times 3 = 26400 \text{ ft. ;}$$

$$26400 \times 12 = 316800 \text{ inches ;}$$

$$\text{Ans. } 316800 \text{ in.}$$

(20)

$$2730 \div 12 = 227 \text{ ft. 6 in. ;}$$

$$227 \div 3 = 75 \text{ yd. 2 ft. ;}$$

$$\text{Ans. } 75 \text{ yd. 2 ft. 6 in.}$$

(21)

$$56 \div 9 = 6 \text{ sq. yd. 2 sq. ft. Ans.}$$

(22)

$$355 \div 40 = 8 \text{ R. } 35 \text{ P. ; } 8 \div$$

$$4 = 2 \text{ A. ; } 2 \text{ A. } 0 \text{ R. } 35 \text{ P. Ans.}$$

(23)

$$456 \div 10 = 45 \text{ A. 6 sq. ch. Ans.}$$

(24)

$$3 \times 4 + 2 = 14 \text{ R. ;}$$

$$14 \times 40 + 8 = 568 \text{ P. ;}$$

$$568 \text{ P. Ans.}$$

(25)

$$14 \times 40 = 560 \text{ cu. ft. ; } 560 \times 1728 = 967680 \text{ cu. in. Ans.}$$

(26)

$$\text{Ans. } 31 \times 128 = 3968 \text{ cu. ft.}$$

(27)

$$56320 \div 128 = 440 \text{ cords.}$$

(28)

$$157 \times 4 = 628 \text{ qr. ;}$$

$$628 \times 4 = 2512 \text{ na. } \textit{Ans.}$$

(29)

$$192 \times 3 = 576 \text{ qr. ;}$$

$$576 \div 4 = 144 \text{ yd. } \textit{Ans.}$$

(30)

$$97 \times 4 + 3 = 391 \text{ qr. ;}$$

$$391 \div 5 = 78 \text{ E. E. } 1 \text{ qr. } \textit{Ans.}$$

(31)

$$4 \times 63 = 252 \text{ gal. ; } 252 \times 4 =$$

$$1008 \text{ qt. ; } 1008 \text{ qt. } \textit{Ans.}$$

(32)

$$7560 \div 2 = 3780 \text{ qt. ; } 3780 \div 4 = 945 \text{ gal. ;}$$

$$945 \div 63 = 15 \text{ hhd. } \textit{Ans.}$$

(33)

$$7 \times 54 = 378 \text{ gal. ; } 378 \times 4 = 1512 \text{ qt. ;}$$

$$1512 \times 2 = 3024 \text{ pt. } \textit{Ans.}$$

(34)

$$74304 \div 2 = 37152 \text{ pt. ;}$$

$$37152 \div 2 = 18576 \text{ qt. ;}$$

$$18576 \div 4 = 4644 \text{ gal. ;}$$

$$4644 \div 36 = 129 \text{ bbl. } \textit{Ans.}$$

(35)

$$31 \times 4 = 124 \text{ pk. ;}$$

$$124 \times 8 = 992 \text{ qt. ;}$$

$$992 \times 2 = 1984 \text{ pt. } \textit{Ans.}$$

(36)

$$2110 \div 2 = 1055 \text{ qt. ; } 1055 \div 8 = 131 \text{ pk. } 7 \text{ qt. ;}$$

$$131 \div 4 = 32 \text{ bu. } 3 \text{ pk. } 32 \text{ bu. } 3 \text{ pk. } 7 \text{ qt. } \textit{Ans.}$$

(37)

$$365 \times 24 + 5 = 8765 \text{ hr.}$$

$$8765 \times 60 + 48 = 525948 \text{ min. ;}$$

$$525948 \times 60 + 48 = 31556928 ;$$

$$31556928 \times 2 = 63113856 \text{ sec. } \textit{Ans.}$$

(38)

$$254 \div 30 = 8 \text{ mo. } 14 \text{ da.}$$

$$14 \div 7 = 2 \text{ wk. ;}$$

$$8 \text{ mo. } 2 \text{ wk. } = \textit{Ans.}$$

ADDITION.

(39)	(40)	(41)
19553068	43002168	10492
434495	48905879	10492
3204313	46007893	10492
400674	137915940	5976
23592550		5976

3 sons' shares.

2 daughters' shares

43428 = children's shares.

1200

44628 = widow's share.

43428

88056 = fortune.

(42)

27 mi.	3 fur.	36 rd.
32 "	0 "	10 "
36 "	2 "	0 "
25 "	6 "	0 " 38 ft.

121 mi. 4 fur. 8 rd. 5 ft.

(43)	(44)	(45)
8.75	5.375	5 hhd. 36 gal. 2 qt.
5.625	12.03	3 " 15 " 1 " 1 pt.
3.125	.875	1 " 0 " 2 " 0 "
4.509	9.46	40 " 0 " 1 "
\$22.009	\$27.740	2 T. 2 hhd. 29 gal. 2 qt. 0 pt.

(46)	(47)	(48)
4798005	9219251	25840
7285817	10031283	3186
8224853	11319319	\$29026
\$20308675	\$30569853	

(49)

2870.43	476.25
2346.75	476.25
1563.82	476.25
\$6781.00 = cost of 3 lots.	\$1428.75 = gain.
1428.75	
\$8209.75 = price received.	

(50)

79650
25640
9654
16835
12642
5685
\$150106

(51)

9375
1706
4824
13280
529

29714

(52)

11020855
7970195
14543789
14822870
1752316

\$50110025

(53)

51888882
7852571
67059

\$59808512

(54)

	18 cwt.	2 qr.	16 lb.
1 T.	5 "	0 "	21 "
		2 "	14 "
2 T.	4 cwt.	2 qr.	1 lb.

(55)

84 A.	3 R.	26 P.
120 "	0 "	14 "
205 A.	0 R.	0 P.

(56)

25000.765
25000.765
25000.765

\$75002.295

(57)

1375	4450
1810	2975
1265	
4450 = yield.	\$7425 = value.

(58)

1 lb.	6 oz.	12 pwt.	0 gr.
	10 "	18 "	20 "
	11 "	0 "	16 "
1 "	0 "	14 "	12 "
4 lb.	5 oz.	6 pwt.	0 gr.

(59)

389664
573234
40722
49800

1053420

(60)

43
1799

1842 years.

(61)

7500
12865
4680
3296
4000

Ans. 32341

(62)

5164.50
11810.25
3004.00
2384.16
2384.16
2384.16

Ans. \$27131.23

(63)

20.00
4.60
2.63
.875

\$28.105 Ans.

(64)				(65)	(66)
12 yd.	2 qr.	0 na.		9.25	12540.375
16 "	1 "	3 "		45.50	5632.108
10 "	1 "	1 "		110.75	5632.108
<hr/>				12.125	5632.108
Ans. 39 yd.	1 qr.	0 na.		3.20	5632.108
				<hr/>	
				Ans. \$180.825	35068.807

(67)				(68)	(69)
£25	13s.	6d.	0-far.	13121498	825.875
15	8s.	9d.	2 "	15367691	67.125
18	0s.	0d.	0 "	11212616	80.10
<hr/>				14487351	46.00
Ans. £59	2s.	3d.	2 "	2981652	
				9414575	\$1019.100
				<hr/>	

(70)	(71)
\$7825 capital of 1st.	240 bu. 3 pk. 2 qt.
1250	97 " 0 " 6 "
\$9075 capital of 2d.	42 " 1 " 0 "
7825	<hr/>
\$1690 = capital of 3d.	380 bu. 1 pk. 0 qt.
7825	
9075	
Ans. \$33800 = whole capital.	

(72)	(73)	(74)
300	£17 10s. 6d.	4750
100.00	25 4s. 10d. 2 far.	695
4.00	18s. 6d. 3 "	165
.96	11 0s. 9d. 1 "	625
.007	1 18s. 0d. 0 "	
9.00	1 1s. 6d. 1 "	Ans. 6235
.47	<hr/>	
.005	Ans. £57 14s. 2d. 3 far.	
40.000		
3.000	(75)	
.900	37° 34' N.	
Ans. \$458.342	29° 16' S.	
	<hr/>	
	Ans. 66° 50'	

(76)

19 cwt. 3 qr.	582.68
22 " 1 " 18 lb.	83.24
16 " 2 " 12 "	166.48
24 " 1 " 19 "	<u>\$832.40</u>
83 cwt. 0 qr. 24 lb.	

83 cwt. 0 qr. 24 lb. = 8324 lb.

\$832.40 = 83240 cents.

83240 ÷ 8324 = 10 cents. *Ans.*

(77)

1656
427
430
479
476
536
<u>1864</u>

Ans. 5868

SUBTRACTION.

(39)

10000.000
<u>1240.375</u>
\$8759.625

(40)

183701289
<u>34627</u>
183666662

(41)

17 yr. 9 mo. 1 wk. 6 da.
<u>10 " 11 " 2 " 5 "</u>
6 yr. 9 mo. 3 wk. 1 da.

(42)

144 lb	7 $\frac{3}{4}$	53	1 D
<u>56 "</u>	<u>6 "</u>	<u>7 "</u>	<u>1 "</u>
<i>Ans.</i> 88 lb	0 $\frac{3}{4}$	63	0 D

(43)

20.70
<u>12.50</u>
\$8.20

(44)

40.125
<u>.257</u>
\$39.868

(45)

15.700
<u>5.074</u>
\$10.626 <i>Ans.</i>

(46)

£133 11s. 9d. 2 far.
<u>11 14s. 9d. 1 "</u>
£121 17s. 0d. 1 far. <i>Ans.</i>

(47)

21 yr. 0 mo. 0 wk. 0 da. 0 hr. 0 min.
<u>14 " 11 " 3 " 0 " 14 " 58 "</u>
6 yr. 0 mo. 0 wk. 6 da. 9 hr. 2 min. <i>Ans.</i>

(48)

7304010
<u>950140</u>
6353870

(49)

21427

156805747 *Ans.*

(50)

7530

15106020 *Ans.*

(51)

4537046.16

7203048.52

836437.99

12576532.67

38289341.58

12576532.67*Ans.* 25712808.91

(52)

46500

1031036190 *Ans.*

(53)

683021

902563

1585584 = min.

1585584

902563683021 *Ans.*

(54)

124336054

16891020107445034 *Ans.*

(55)

10000

37266274 *Ans.*

(56)

9 T. 0 cwt. 3 qr. 20 lb.

4 " 17 " 0 " 22 "4 T. 3 cwt. 2 qr. 23 lb. *Ans.*

(57)

£25 0s. 0d. 0 far.

5 0s. 9d. 1 "£19 19s. 2d. 3 far. *Ans.*

(58)

3100 mi. 0 fur. 0 rd.

800 " 5 " 36 "2299 mi. 2 fur. 4 rd. *Ans.*

(59)

3500.500

3300.875199.625 *Ans.*

(60)

925.875

750.000\$175.875 *Ans.*

(61)

1.875

20.00

2.50016.75

12.375

\$3.25

16.750

(62)

$$\begin{array}{r} 23191876 \\ 3204313 \\ \hline 19987563 \text{ Ans.} \end{array}$$

(63)

$$\begin{array}{r} \overbrace{\begin{array}{r} 50922 \\ 31324 \\ \hline 7398 \\ 89644 \end{array}} \quad \overbrace{\begin{array}{r} 2988892 \\ 89644 \\ \hline 2899248 \text{ Ans.} \end{array}} \end{array}$$

(64)

$$\begin{array}{r} \overbrace{\begin{array}{r} 30000 \\ 25250 \\ 25250 \\ 25250 \\ 20575 \\ \hline 126325 \end{array}} \quad \overbrace{\begin{array}{r} 200000 \\ 126325 \\ \hline 73675 \text{ Ans.} \end{array}} \end{array}$$

(65)

$$\begin{array}{r} 139190 \\ 116375 \\ \hline 22815 \end{array}$$

(66)

$$\begin{array}{r} \overbrace{\begin{array}{r} 475.125 \\ 300.000 \\ 526.25 \\ \hline 1301.375 \end{array}} \quad \overbrace{\begin{array}{r} 1500.000 \\ 1301.375 \\ \hline 198.625 \end{array}} \end{array}$$

(67)

$$\begin{array}{r} 1857 \text{ yr. } 3 \text{ mo. } 4 \text{ da. } 15 \text{ hr. } 30 \text{ min.} \\ 1776 \text{ " } 7 \text{ " } 4 \text{ " } 12 \text{ " } 0 \text{ "} \\ \hline 80 \text{ yr. } 8 \text{ mo. } 0 \text{ da. } 3 \text{ hr. } 30 \text{ min. } \text{Ans.} \end{array}$$

(68)

$$\begin{array}{r} 1576.000 \\ 920.875 \\ \hline 655.125 \end{array}$$

(69)

$$\begin{array}{r} 1856 \text{ yr. } 7 \text{ mo. } 4 \text{ da.} \\ 1607 \text{ " } 5 \text{ " } 23 \text{ " } \\ \hline 249 \text{ yr. } 1 \text{ mo. } 11 \text{ da. } \text{Ans.} \end{array}$$

(70)

$$\begin{array}{r} 36804 \\ 18927 \\ \hline 17877 \text{ Ans.} \end{array}$$

(71)

$$\begin{array}{r} 61337574 \\ 54026818 \\ \hline 7310756 \end{array}$$

(72)

$$\begin{array}{r} 19 \text{ cwt. } 1 \text{ qr. } 15 \text{ lb.} \\ 14 \text{ " } 3 \text{ " } 22 \text{ " } \\ \hline 4 \text{ cwt. } 1 \text{ qr. } 18 \text{ lb. } \text{Ans.} \end{array}$$

(73)

$$\begin{array}{r} 50376 \\ 42978 \\ \hline 7398 \text{ Ans.} \end{array}$$

(74)

$$\begin{array}{r} 6375 \\ 4015 \\ \hline 2360 \text{ Ans.} \end{array}$$

(75)

$$\begin{array}{r} 1856 \\ 1330 \\ \hline 526 \text{ Ans.} \end{array}$$

(76)

$$\begin{array}{r} 12103 \\ 5829 \\ \hline 6274 \text{ Ans.} \end{array}$$

(77)

2084.500	2375.600	5037.975
760.875	912.375	4681.625
1836.25	1750.000	\$356.350 gain.
\$4681.625 paid.	\$5037.975 received.	

(78)

9 A. 3 R. 32 P.	10 A. 2 R. 0 P
12 " 0 " 29 "	15 " 1 " 20 "
22 A. 0 R. 21 P.	25 A. 3 R. 20 P
	22 " 0 " 21 "
	3 A. 2 R. 39 P. <i>Ans.</i>

(79)

48 ÷ 16 = 3 cd. ft.	20 cords 3 cd. ft.	76 cords 6 cd. ft.
80 ÷ 16 = 5 cd. ft.	14 " 6 "	35 " 1 "
	35 cords 1 cd. ft. <i>Ans.</i>	41 cords 5 cd. ft.

(80)

9436.00	5260.000
475.50	1275.375
840.40	936.42
10751.90	7471.795

(81)

47568.487
3406.500
\$44161.987 <i>Ans.</i>

$$\$10751.90 - \$7471.795 = \$3280.105 \text{ Ans.}$$

(82)

1856 yr. 3 mo. 20 da.
1853 " 7 " 1 "
2 yr. 8 mo. 19 da.

(83)

5647.50	50000.00
15000.00	35647.50
15000.00	\$14352.50 <i>Ans.</i>
35647.50	

(84)			(85)	(86)	
63 gal.	0 qt.	0 pt.	80025	1500	25000
32 "	1 "	1 "	29963	4700	9450
30 gal.	2 qt.	1 pt.	50062	2500	15550
				750	Ans.
				9450	

(87)			(88)	(89)
42°	21'	23"	300.000	20936468
29°	57'	30"	410.500	18664761
12°	23'	53"	50.675	2271707
			761.175	
			761.175	
			600.000	
			\$161.175 loss. Ans.	
				(90)
				47 yd. 0 qr. 0 na.
				14 " 3 " 2 "
				32 yd. 0 qr. 2 na.

(91)			
£105 19s. 11d. 0 far.	£50 0s. 0d.	£1470 3s. 1d.	
127 10s. 9d. 2 "	350 14s. 9d.	520 0s. 5d.	
34 18s. 10d. 0 "	24 11s. 0d.	£950 2s. 8d. A.	
500 19s. 0d. 0 "	94 14s. 8d.		
700 14s. 6d. 2 "	£520 0s. 5d.		
£1470 3s. 1d. 0 far.			

MULTIPLICATION.

(17)	(18)
Ans. $2479 \times 25 = \$61975$	$15 \times 24 \times 9 = 3240$ miles.

(19)
$125 \times 26 = \$3250$; $96 \times 32 = \$3072$; $3250 + 3072 = \$6322$; $2500 + 1725 = \$4225$; $6322 - 4225 = \$2097$. Ans.

(20)			(21)		
14 yd.	3 qr.	2 na.	5s.	3d.	2 far.
		9			15
133 yd.	3 qr.	2 na.	£3 19s.	4d.	2 far.
					<i>Ans.</i>

(22)

$$\$2.48 \times 416 = \$1031.68 \text{ Ans.}$$

(23)

$$\$8.75 \times 40 = \$350 ; \$9.125 \times 40 = \$365 ; \$365 - 350 = \$15 \text{ A.}$$

(24)

$$7 \text{ cwt. } 2 \text{ qr. } 18 \text{ lb.} = 768 \text{ lb.} ; 768 \times 11 = 8448 \text{ lb.} ;$$

$$8448 \times .06 = \$506.88 \text{ Ans.}$$

(25)

$$44 \times 36 \times 4 = \$6336 \text{ Ans.}$$

(26)

$$600 + 570 + 1200 = \$2370 ; 3479 - 2370 = \$1109 ;$$

$$1109 \times 5 = \$5545 \text{ Ans.}$$

(27)

$$931324 \times 18 = \$16763832 \text{ Ans.}$$

(28)			(29)	
20 mi.	5 fur.	16 rd.	$365 \times 30 \times .06 = \657 Ans.	
		3		
62	0	8		
		8		
496 mi.	1 fur.	24 rd.	<i>Ans.</i>	

(30)

$$118 \times .62\frac{1}{2} = \$73.75$$

$$9.875 \times 5 = \underline{49.375}$$

$$\$24.375 \text{ Ans.}$$

(31)

$$(34 + 28) \times 14 = 868 \text{ miles. } \textit{Ans.}$$

(32)

$$10 \frac{3}{8} \text{ } 63 \text{ } 2 \text{ } \textcircled{D} \text{ } 14 \text{ gr.}$$

(33)

$$\begin{array}{r} 2 \text{ bu. } 3 \text{ pk. } 6 \text{ qt.} \\ \underline{20} \end{array}$$

$$\begin{array}{r} 58 \text{ bu. } 3 \text{ pk. } 0 \text{ qt.} \\ \underline{7} \end{array}$$

$$411 \text{ bu. } 1 \text{ pk. } 0 \text{ qt. } \textit{Ans.}$$

$$7 \text{ lb } 2 \frac{3}{4} \text{ } 73 \text{ } 0 \text{ } \textcircled{D} \text{ } 12 \text{ gr}$$

(34)

$$2018 \times 212 = 427816 \text{ bbl. } \textit{A.}$$

(35)

$$7 \text{ cwt. } 2 \text{ qr. } 16 \text{ lb.} = 766 \text{ lb. ; } 766 \times .11 = \$84.26 \textit{ Ans.}$$

(36)

$$984 \times 245 \times .07 = \$16875.60 \textit{ Ans.}$$

(37)

	18 cwt.	3 qr.	21 lb.
			6
5	13	3	1
2	15	1	5
2 T.	18 cwt.	1 qr.	21 lb.

(38)

$$136 \times 17 = 2312 \text{ bu. ; } 2312 \times .42 = \$971.04 \textit{ Ans.}$$

(39)

$$1845 \times 7 = \$12915 ; 528 \times 9 = \$4752 ;$$

$$856 \times 8 = \$6848 ; 4752 + 6848 = \$11600 ;$$

$$528 \times 856 = 1384 ; 1845 - 1384 = 461 \text{ bbl., left ;}$$

$$12915 - 11600 = \$1315, \text{ value of } 461 \text{ bbl.}$$

(40)

$$872 \times 25 \times .06 \frac{1}{2} = \$1417 \textit{ Ans.}$$

(41)

$$52770231 \times \$1.25 = \$65962788.75 \text{ Ans.}$$

(42)

$$25 \times 30 = 750 \text{ days. Ans.}$$

(43)

$$2700 \times 5 = \$13500 \text{ Ans.}$$

(44)

$$72 \times 9 \times .37\frac{1}{2} = \$243 \text{ Ans.}$$

(45)

$$46 \times 37 \times 7 = \$11914 \text{ Ans.}$$

(46)

$$\$37.565 \times 127 = \$4770.755 \text{ Ans.}$$

(47)

$$127 \times 39 = \$4953 ; 43 \times 86 = \$3698 ;$$

$$127 - 86 = 41 \text{ cattle left ; } 4953 - 3698 = 1255 ;$$

$$1255 + 1246 = 2501 ; 2501 \div 41 = \$61 \text{ Ans.}$$

(48)

$$16 \times 56 \times 75 = \$672 \text{ Ans.}$$

(49)

$$\begin{array}{r} 1856 \text{ yr. } 9 \text{ mo. } 4 \text{ da.} \\ 1850 \text{ " } 4 \text{ " } 20 \text{ "} \\ \hline \end{array}$$

$$6 \text{ yr. } 4 \text{ mo. } 14 \text{ da.}$$

5

$$\begin{array}{r} 31 \text{ yr. } 10 \text{ mo. } 10 \text{ da.} \\ 9 \\ \hline \end{array}$$

$$286 \text{ yr. } 9 \text{ mo. } 0 \text{ da. Ans.}$$

(50)

$$16 \text{ ft. } 8 \text{ in.} \times 84 = 84 \text{ rd. } 14 \text{ ft. } A.$$

(51)

$$8 \times 2 + 50 = 66 ; 58 \times 2 = 116 ;$$

$$116 - 66 = 50 \text{ Ans.}$$

(52)

$$5 \text{ cords } 6 \text{ cord feet } 32 \text{ cu. ft.} \times 4 = 24 \text{ cords. Ans.}$$

(53)

$$56 \times 25 = \$1400 ; 94 \times 32 = \$3008 ; 1400 + 3008 = 4408 ;$$

$$(56 + 94) \times 30 = \$4500 ; 4500 - 4408 = \$92, \text{ gain. } \textit{Ans.}$$

(54)

$$12 \times 9 \times 2 = 216 \text{ men. } \textit{Ans.}$$

(55)

$$25.50 \times 4 = 102$$

$$2.125 \times 12 = 25.50$$

$$7.25 \times 3 = 21.75$$

(56)

$$326 \times 116 = 37816 \text{ tons. } \textit{Ans.}$$

$$\underline{\$149.25} \text{ } \textit{Ans.}$$

(57)

$$960 \times .09 = 86.40 ; \$4.75 \times 12 = \$57 ; \$104.90 - 70.02 = \$34.88 ;$$

$$148 \times .12\frac{1}{2} = 18.50 ; 186 \times .07 = \$13.02$$

$$\underline{\$104.90}$$

$$\underline{\$70.02}$$

(58)

$$1 \text{ gal. } 2 \text{ qt. } 1 \text{ pt. } 2 \text{ gi.} = 54 \text{ gi. ;}$$

$$54 \text{ gi.} \times 25000 = 1350000 \text{ gi.} = 669 \text{ hhd. } 40 \text{ gal. } 2 \text{ qt. } \textit{Ans.}$$

(59)

$$100 + 95 = 195 ; 195 \times 70000 = \$13650000.$$

(60)

$$39 \times 27 = \$1053 ; 70 = 27 \times .45 = \$850.50 ;$$

$$1053 - 850.50 = 202.50 \text{ } \textit{Ans.}$$

(61)

14 pounds of tea,	at 75 cents,	.	.	.	\$10.50
9 " " coffee,	14 "	.	.	.	1.26
42 " " sugar,	11 "	.	.	.	4.62
3 " " pepper,	12 $\frac{1}{2}$ "	.	.	.	.375
5 " " chocolate,	56 "	.	.	.	2.80
12 " " candles,	16 "	.	.	.	1.92

$$\text{Amount, . . . } \underline{\$21.475}$$

(62)

48 pounds of sugar at $9\frac{1}{2}$ cents a pound, . . .	\$4.56
6 hogsheads of molasses, each containing 63 gal- lons, at 27 cents a gallon, . . .	105.06
8 casks of rice, 285 lb. each, at 5 cents a pound, . . .	114.00
9 chests of tea, 86 lb. each, at $87\frac{1}{2}$ cents a pound, . . .	617.25
4 bags of coffee, each 67 lb., at 11 cents a pound, . . .	29.48
Amount, . . .	<u>\$927.35</u>

(63)

78 chests of tea, at \$55.65 per chest, . . .	\$4340.70
251 bags of coffee, 100 lb. each, at $12\frac{1}{2}$ cents per pound, . . .	3137.50
317 boxes of raisins, at \$2.75 per box, . . .	871.75
1049 barrels of shad, at \$7.50 per barrel, . . .	7867.50
76 barrels of oil, 32 gallons each, at \$1.08 per gallon, . . .	2626.56
Amount, . . .	<u>\$18844.01</u>

(64)

10 yards of broadcloth, at \$4.37 $\frac{1}{2}$, . . .	\$43.75
75 " " sheeting, at .09 . . .	6.75
42 " " plaid prints, at .45, . . .	18.90
5 barrels of Genesee flour, at \$7.87 $\frac{1}{2}$, . . .	39.375
7 pairs of boots, at \$1.60 per pair, . . .	11.20
18 bushels of corn, at 72 cents per bushel, . . .	12.96
Amount, . . .	<u>\$132.935</u>

(65)

	£	s.	d.
45 yards of broadcloth, at 9s. 6d., . . .	21	7	6
56 " " at 12s. 9 $\frac{1}{2}$ d., . . .	35	15	2
16 " vestings, at 6s. 8 $\frac{1}{2}$ d., . . .	5	7	4
24 lb. colored thread, at 5s. 4d., . . .	6	8	0
72 pairs silk hose, at 7s. 5 $\frac{1}{2}$ d., . . .	26	18	6
108 yards carpeting, at 14s. 10d., . . .	80	2	0
Amount, . . .	<u>£175</u>	<u>18</u>	<u>6</u>

DIVISION.

(44)

41)729 A. 2 R. 7 P. (17 A. 3 R. 7 P. *Ans.*41

319

287

32

4

130

123

7

40

287

287

...

(45)

240)365 da. 6 hr. (1 da. 12 hr. 31 min. 30 sec. *Ans.*240

125

24

3006

240

606

480

126

60

7560

720

360

240

120

60

7200

720

..0

(49)

\$18306.25 ÷ 725 = \$25.25 *Ans.*

(50)

16s. 4d. ÷ 7 = 2s. 4d. *Ans.*

(51)

265 mi. 6 fur. 16 rd. ÷ 12 =
22 mi. 1 fur. 8 rd. *Ans.*

(52)

569 A. 2 R. 23 P. ÷ 9 =

63 A. 1 R. 7 P.

63 A. 1 R. 7 P. × 5 =

316 A. 1 R. 35 P. *Ans.*

(53)

\$10000 ÷ 365 = \$27.397. *Ans.*

(54)

987551235 ÷ 9999 = 98765 *Ans.*

(55)

\$75000 ÷ 4 = \$18750 ; 75000 - 18750 = \$56250 ;

56250 ÷ 5 = \$11250 *Ans.*

(56)

$$\$54026818 \div 365 = \$148018\frac{42}{117}. \text{ Ans.}$$

(57)

$$\$133.00 \div 28 = \$4.75 \text{ Ans.}$$

(58)

$$\$637.50 \div 51 = \$12.50 \text{ Ans}$$

(59)

$$78747600 \div 104 = 757188\frac{48}{104}. \text{ Ans.}$$

(60)

$$\$30.875 \div 19 = \$1.625 \text{ Ans.}$$

(61)

$$5 \times 5 = 25 \text{ loaves per day ;}$$

$$9125 \div 25 = 365 \text{ days. Ans.}$$

(62)

$$7207272072 \div 9009 = 800008 \text{ Ans.}$$

(63)

$$10 \text{ oz. } 11 \text{ pwt. } 12 \text{ gr.} \div 4 \text{ pwt. } 12 \text{ gr.} = 5076 \text{ gr.} \div 108 \text{ gr.} =$$

$$47 \text{ rings. Ans.}$$

(64)

$$\$67.50 = 6750 \text{ cents ; } 6750 \div 2 = 3375 \text{ lb.} = 1 \text{ T. } 13 \text{ cwt. } 3 \text{ qr.}$$

(65)

$$12 \text{ T. } 88 \text{ ft. } 118 \text{ in.} \div 14 = 45 \text{ cu. ft. } 995\frac{1}{4} \text{ cu. in. Ans.}$$

(66)

$$285702 \div 9285 = 30\frac{1162}{9285} \text{ Ans.}$$

(67)

$$942321 \div 213 = 4424\frac{9}{113} \text{ Ans.}$$

(68)

$$360^{\circ} 0' 0'' \div 365 = 59' 10' \frac{2}{3} \frac{1}{2} \text{ Ans.}$$

(69)

$$8 \text{ lb. } 11 \text{ oz.} \div 15 \text{ pwt. } 16 \text{ gr.} = 22560 \text{ gr.} \div 376 \text{ gr.} = 60 = 5 \text{ doz.}$$

(70)

$$\$3.25 \times 48 = \$156; 156 \div 60 = 216; 216.00 \div 48 = \$4.50 \text{ A.}$$

(71)

$$£75 \text{ 18s. } 9\text{d.} \div 5 = £15 \text{ 3s. } 9\text{d.}; £15 \text{ 3s. } 9\text{d.} \times 18 = £273 \text{ 7s. } 6\text{d.}$$

(72)

$$75 \text{ mi.} = 4752000 \text{ in.}; 9 \text{ ft. } 6 \text{ in.} = 114 \text{ in.};$$

$$4752000 \div 114 = 41684 \frac{24}{114} \text{ Ans.}$$

(73)

$$12 - 6 = 12, \text{ product}; 12 \div 4 = 3, \text{ quotient}; 3 \times 3 = 9 \text{ Ans.}$$

(74)

$$\$28372 \div 512 = \$56 \text{ Ans.}$$

(75)

$$288120 \div 432 = 666 \frac{40}{432} \text{ Ans.}$$

(76)

$$96000000 \div 8 = 12000000; 12000000 \div 60 = 200000 \text{ Ans.}$$

CONTRACTIONS IN MULTIPLICATION.

(1)

$$287 \times 25 = 28700 \div 4 = 7175 \text{ Ans.}$$

(2)

$$184 \times 25 = 18400 \div 4 = 4600 \text{ Ans.}$$

(3)

$$6741 \times 25 = 674100 \div 4 = 168525 \text{ Ans.}$$

(4)

$$3074 \times 25 = 307400 \div 4 = 76850. \text{ Ans.}$$

(1)

$$\begin{array}{r} 327 \\ 8\frac{1}{2} \\ \hline 109 \\ 2616 \\ \hline 2725 \text{ Ans.} \end{array}$$

(2)

$$\begin{array}{r} 23474 \\ 16\frac{1}{2} \\ \hline 11737 \\ 140844 \\ 23474 \\ \hline 387321 \text{ Ans.} \end{array}$$

(3)

$$\begin{array}{r} 34700 \\ 127\frac{1}{2} \\ \hline 6940 \\ 242900 \\ 69400 \\ 34700 \\ \hline 4418840 \text{ Ans.} \end{array}$$

(4)

$$\begin{array}{r} 1272 \\ 12\frac{1}{2} \\ \hline 159 \\ 15264 \\ \hline 15423 \end{array}$$

(5)

$$\begin{array}{r} 9824 \\ 272\frac{1}{2} \\ \hline 2456 \\ 19648 \\ 68768 \\ 19648 \\ \hline 2674584 \text{ Ans.} \end{array}$$

(6)

$$\begin{array}{r} 3828 \\ 73\frac{1}{2} \\ \hline 638 \\ 11484 \\ 26796 \\ \hline 280082 \text{ Ans.} \end{array}$$

(1)

$$384 \times 12\frac{1}{2} = 38400 \div 8 = 4800 \text{ Ans.}$$

(2)

$$476 \times 12\frac{1}{2} = 47600 \div 8 = 5950 \text{ Ans.}$$

(3)

$$14800 \times 12\frac{1}{2} = 1480000 \div 8 = 185000 \text{ Ans.}$$

(4)

$$670418 \times 12\frac{1}{2} = 67041800 \div 8 = 8380225 \text{ Ans.}$$

(1)

$$1679252 \times 33\frac{1}{3} = 167925200 \div 3 = 55975066\frac{2}{3} \text{ Ans.}$$

(2)

$$1480724 \times 33\frac{1}{3} = 148072400 \div 3 = 49357466\frac{2}{3} \text{ Ans.}$$

(3)

$$10675512 \times 33\frac{1}{3} = 1067551200 \div 3 = 355850400 \text{ Ans}$$

(4)

$$4442172 \times 333\frac{1}{3} = 4442172000 \div 3 = 1480724000 \text{ Ans}$$

(1)

$$59264 \times 125 = 59264000 \div 8 = 7408000 \text{ Ans.}$$

(2)

$$17593408 \times 125 = 17593408000 \div 8 = 2199176000 \text{ Ans.}$$

(3)

$$1940812 \times 125 = 1940812000 \div 8 = 242601500 \text{ Ans.}$$

(4)

$$140588 \times 125 = 140588000 \div 8 = 17573500 \text{ Ans.}$$

(1)

$$284 \times 50 \text{ cents} = 284 \div 2 = \$142 \text{ Ans.}$$

(2)

$$51 \times 33\frac{1}{3} = 51.00 \div 3 = \$17.00 \text{ Ans.}$$

(3)

$$112 \times .12\frac{1}{2} = 112.00 \div 8 = \$14. \text{ Ans.}$$

(4)

$$175 \times .20 = 175.00 \div 5 = \$35.00 \text{ Ans.}$$

(5)

$$576 \times 1.50 = 576 \times 1\frac{1}{2} = \$864 \text{ Ans.}$$

(6)

$$129 \times 1.33\frac{1}{3} = 129 \times 1\frac{1}{3} = \$172 \text{ Ans.}$$

(7)

$$96 \times 1.25 = 96 \times 1\frac{1}{4} = \$120 \text{ Ans.}$$

(8)

$$25 \times 1.20 \times 3 = 25 \times 1\frac{1}{5} \times 3 = \$90 \text{ Ans.}$$

(1)

$$3742 \times 3.25 \div 100 = \$121.615 \text{ Ans.}$$

(2)

$$5400 \times 12.50 \div 1000 = \$67.50 \text{ Ans.}$$

(3)

$$7568 \times \$9.75 \div 100 = \$737.88 \text{ Ans.}$$

(4)

$$19875 \times 25 \div 1000 = \$496.875 \text{ Ans.}$$

(5)

$$1275 \times 9 \div 1000 = \$11.475$$

$$3720 \times 15.25 \div 1000 = 56.730$$

$$715 \times 8.75 \div 1000 = 6.25625$$

$$1200 \times 12.06 \div 1000 = 14.472$$

$$2550 \times .75 \div 100 = 19.125$$

$$965 \times 1.12\frac{1}{2} \div 100 = 10.85625$$

$$\$118.91450 \text{ Ans.}$$

(1)

$$\$3.84 \div 2 = 1.92; 1575 \times 1.92 \div 1000 = \$3.024 \text{ Ans.}$$

(2)

$$7.37\frac{1}{2} \div 2 = 3.6875; 3496 \times 3.6875 \div 1000 = \$12.8915 \text{ Ans.}$$

(3)

$$9.40 \div 2 = 4.70; 10.25 \div 2 = 5.125; 14.60 \div 2 = 7.30.$$

$$1260 \times 4.70 \div 1000 = \$5.922; 1260 \times 5.125 \div 1000 = \$6.4575;$$

$$1260 \times 7.30 \div 1000 = \$9.198 \text{ Ans.}$$

(4)

$$6.65 \div 2 = 3.325; 5482 \times 3.325 \div 1000 = \$18.22765 \text{ Ans.}$$

(5)

$$1.87\frac{1}{2} \div 2 = .9375; 785797 \times .9375 \div 1000 = \$736.6846875$$

(6)

$$26 \div 2 = 13; 67418 \times 13 \div 1000 = \$876.434 \text{ Ans.}$$

(7)

$$9.75 \div 2 = 4.875; 497046 \times 4.875 \div 1000 = \$2423.09925$$

(8)

$$75 \div 2 = 37\frac{1}{2}; 9047641 \times 37\frac{1}{2} \div 1000 = \$339286.5375$$

CONTRACTIONS IN DIVISION.

(1)

$$6350 \times 4 \div 100 = 254 \text{ Ans.}$$

(2)

$$656280 \times 4 \div 100 = 26251\frac{20}{100}$$

(3)

$$7278675 \times 4 \div 100 = 291147 \text{ Ans.}$$

(4)

$$5287215 \times 4 \div 100 = 211488 \frac{15}{100} \text{ Ans.}$$

(5)

$$12225 \times 8 \div 100 = 978 \text{ Ans.}$$

(6)

$$11925 \times 8 \div 100 = 954$$

(7)

$$1760600 \times 8 \div 100 = 140848 \text{ Ans.}$$

(8)

$$67500 \times 3 \div 100 = 2025$$

(9)

$$1308400 \times 3 \div 100 = 39252 \text{ Ans.}$$

(10)

$$15851400 \times 3 \div 100 = 475542 \text{ Ans.}$$

(11)

$$8072400 \times 3 \div 100 = 242172 \text{ Ans.}$$

(12)

$$16144800 \times 3 \div 100 = 484344 \text{ Ans.}$$

(13)

$$31702800 \times 3 \div 100 = 951084 \text{ Ans.}$$

(14)

$$281250 \times 8 \div 1000 = 2250 \text{ Ans.}$$

(15)

$$6015750 \times 8 \div 1000 = 48126 \text{ Ans.}$$

(16)

$$2026875 \times 8 \div 1000 = 16215 \text{ Ans.}$$

(17)

$$6080625 \times 8 \div 1000 = 48645 \text{ Ans.}$$

B*

(18)

$$18047250 \times 8 \div 1000 = 144378.$$

(1)

$$2 \overline{)2322} \div 6$$

$$3 \overline{)1161}$$

387 *Ans.*

(2)

$$4 \overline{)37152} \div 24$$

$$6 \overline{)9288}$$

1548 *Ans.*

(3)

$$6 \overline{)19152} \div 36$$

$$6 \overline{)3192}$$

532 *Ans.*

(4)

$$4 \overline{)38592} \div 48$$

$$12 \overline{)9648}$$

804 *Ans.*

(5)

$$8 \overline{)1145592} \div 72$$

$$9 \overline{)143199}$$

15911 *Ans.*

(6)

$$8 \overline{)185760} \div 96$$

$$12 \overline{)23220}$$

1935 *Ans.*

(7)

$$8 \overline{)115776} \div 64$$

$$8 \overline{)14472}$$

1809 *Ans.*

(8)

$$12 \overline{)463104} \div 144$$

$$12 \overline{)38592}$$

3216 *Ans.*

$$7 \overline{)416705} \div 315$$

(1)

$$9 \overline{)59529} \dots 2 \dots \dots \dots 2$$

$$5 \overline{)6614} \dots 3 \dots \dots \dots 3 \times 7 = 21$$

$$1322 \dots 4 \dots \dots \dots 4 \times 9 \times 7 = 252$$

True remainder 275

$$3 \overline{)804106} \div 462$$

(2)

$$2 \overline{)268035} \dots 1 \dots \dots \dots 1$$

$$7 \overline{)134017} \dots 1 \dots \dots \dots 1 \times 3 = 3$$

$$11 \overline{)19145} \dots 2 \dots \dots \dots 2 \times 2 \times 3 = 12$$

$$1740 \dots 5 \dots \dots \dots 5 \times 7 \times 2 \times 3 = 210$$

True remainder, 226

(3)

$$4)756807 \div 3456$$

$$8)189201 \dots 3 \dots \dots \dots 8$$

$$9)23650 \dots 1 \dots \dots 1 \times 4 = 4$$

$$12)2627 \dots 7 \dots \dots 7 \times 8 \times 4 = 224$$

$$218 \dots 11 \dots \dots 11 \times 9 \times 8 \times 4 = 3168$$

$$\text{True remainder,} \quad 3399$$

(4)

$$3)8741659 \div 105$$

$$5)2913886 \dots 1 \dots \dots \dots 1$$

$$7)582777 \dots 1 \dots \dots 1 \times 3 = 3$$

$$83253 \dots 6 \dots \dots 6 \times 5 \times 8 = 90$$

$$\text{True remainder,} \quad 94$$

(5)

$$5)947043 \div 385$$

$$7)189408 \dots 3 \dots \dots \dots 3$$

$$11)27058 \dots 2 \dots \dots 2 \times 5 = 10$$

$$2459 \dots 9 \dots \dots 9 \times 7 \times 5 = 315$$

$$\text{True remainder,} \quad 328$$

(6)

$$11)4704967 \div 1155$$

$$7)427724 \dots 3 \dots \dots \dots 3$$

$$5)61103 \dots 3 \dots \dots 3 \times 11 = 33$$

$$3)12220 \dots 3 \dots \dots 3 \times 7 \times 11 = 231$$

$$4073 \dots 1 \dots \dots 1 \times 5 \times 7 \times 11 = 385$$

$$\text{True remainder,} \quad 652$$

(7)

$$8)71874607 \div 7560$$

$$7)8984325 \dots 7 \dots \dots \dots 7$$

$$9)1283475 \dots 0$$

$$5)142608 \dots 3 \dots \dots 3 \times 7 \times 8 = 168$$

$$3)28521 \dots 3 \dots \dots 3 \times 9 \times 7 \times 8 = 1512$$

$$9507 \dots 0 \dots \dots$$

$$\text{True remainder,} \quad \underline{1687}$$

(1)

$$42|0000)197|2654(\underline{47} \dots \dots \dots \text{Ans.} \quad 12|000)1752|000(146 \text{ Ans.}$$

$$\quad \underline{168} \quad \quad \quad \underline{1752}$$

$$\quad 292654 \quad \quad \quad 000$$

(3)

$$8014|00)731990|06(\underline{91} \dots \dots \dots \text{Ans.}$$

$$\quad \underline{729274}$$

$$\quad 271606$$

(4)

$$72|000(11428729|800(1587327 \dots \dots \dots \text{Ans.}$$

$$\quad \underline{72} \dots \dots$$

$$\underline{422}$$

$$\underline{360}$$

$$628$$

$$\underline{576}$$

$$527$$

$$\underline{504}$$

$$232$$

$$\underline{216}$$

$$169$$

$$\underline{144}$$

$$25800 \text{ Rem.}$$

(5)

$$146|000)36981|400(253 \dots \dots \dots$$

$$\quad \underline{292} \dots$$

$$778$$

$$\underline{730}$$

$$481$$

$$\underline{438}$$

$$48400$$

(6)
63|000|141614|398(224743388 Ans.
141561
53398 Rem.

$$\begin{array}{r} (1) \\ 3245 \div 161 \\ \underline{2 \quad 2} \\ 6490 \div 33 \end{array}$$

$$\begin{array}{r} (2) \\ 47804 \div 151 \\ \underline{3 \quad 3} \\ 143412 \div 46 \end{array}$$

(3)

$$\begin{array}{r} 870631 \div 144 \\ \underline{4 \quad 4} \\ 3482524 \div 57 \end{array}$$

33)6490(19624 46)143412(311730 57)3482524(6109644

$$\begin{array}{r} (4) \\ 37214 \div 518 \\ \hline 297712 \div 409 \end{array}$$

$$\begin{array}{r} (5) \\ 87317 \div 9\frac{3}{5} \\ \underline{5 \quad 5} \\ 436585 \div 48 \end{array}$$

409) $297712(727\frac{368}{1000})$ Ans.

48) $436585(9095\frac{5}{8})$ Ans.

(6)

$87906 \div 124 = 615342 \div 88 = 69924\frac{6}{11}$ Ans.

(7)

$$95675 \div 15\frac{5}{6} = 861075 \div 140 = 6150\frac{15}{140} \text{ Ans.}$$

(8)

$$71096 \div 17\frac{3}{4} = 497672 \div 122 = 4079\frac{34}{122} \text{ Ans.}$$

PRACTICE.

		(1)
6	$\frac{1}{2}$	425s. = cost at 1s. per yard.
		212s. 6d. = cost at 6d. per yard.
	20	637s. 6d. = cost at 1s. 6d. per yard.
		£31 17s. 6d. Ans.

(2)

1	$\frac{1}{4}$	475d. = cost at 1d. per yard.
		118d. 3 far. = cost at 1 far. per yard.
12		593d. 3 far. cost at 1d. 1 far. "
		20|49s. 5d.

£2 9s. 5d. 3 far. *Ans.*

(3)

$$354 \times 1\frac{1}{4} = 442\frac{1}{2}d = £1 \ 16s. \ 10\frac{1}{2} \text{ Ans.}$$

(4)

12 $\frac{1}{2}$	$\frac{1}{8}$	\$4756 = cost at \$1 per yard.
		\$594.50 " at 12 $\frac{1}{2}$ cents per yard.

(5)

2 6	$\frac{1}{8}$	£3754 = cost at £1 per pair.
		£469 5s. = cost at 2s. 6d per pair.

(6)

2s.	$\frac{1}{10}$	£5320 = cost at £1 per bushel.
1s.	$\frac{1}{4}$	532 = " 2s. "
6d.	$\frac{1}{2}$	266 = " 1s. "
		133 = " 6d. "
		£931 = " 3s. 6d. per bushel.

(7)

4s.	$\frac{1}{5}$	£435 = cost at £1.
2s.	$\frac{1}{2}$	87 = " at 4s.
1s.	$\frac{1}{2}$	43 10s. = cost at 2s.
		21 15s. = " at 1s.
		£587 5s. = " at 7s.

(8)

$$660 \times 2\frac{1}{2} = 1650s. = \text{£}82 \text{ } 10s. \text{ Ans.}$$

(9)

$$40 \times \frac{1}{4} = 10c. = \text{cost at } \frac{1}{4}c. \text{ per lb.}$$

$$10 \times 3 = 30c. = \text{ " at } \frac{3}{4}c. \text{ "}$$

$$40 \times 6 = 240c. = \text{ " at } 6c. \text{ "}$$

$$240 + 30 = 270c. = \$2.70 = \text{cost at } 6\frac{3}{4} \text{ cents per lb.}$$

(10)

cta.			
50	$\frac{1}{2}$	\$148 = \text{cost at } \\$1 \text{ per yard.}	
		3	
		444 = " at \$3 "	
25	$\frac{1}{2}$	74 = " at 50 cents per yard.	
		37 = " at 25 " "	
		Ans. \$555 = " at \$3.75 "	

(11)

cta.		
50	$\frac{1}{2}$	\$876 = \text{cost at } \\$1.
		438 = " at 50 cents.
12 $\frac{1}{2}$	$\frac{1}{4}$	109.50 = \text{cost at } 12\frac{1}{2} \text{ cents.}
		\$547.50 cost at 62 $\frac{1}{2}$ "

(12)

$$1000 \div 5 = 200$$

$$200 \times 1\frac{1}{2} = 300c.$$

$$300c. = \$3 \text{ Ans.}$$

(14)

$$8.75 \times 6\frac{1}{2} = \$24.375$$

(13)

qr.		
2	$\frac{1}{2}$	\$9.50 = \text{cost of } 1 \text{ yd.}
		85
		4750
		7600
		807.50 = \text{cost of } 85 \text{ yd.}
		4.75 = " 2 qr.
		\$812.25 = " 85 yd. 2 qr.

		(15)
box.		
$\frac{1}{8}$	$\frac{1}{8}$	\$7.25 = cost of 1 box.
		8
		58.00 = " of 8 boxes.
$\frac{1}{4}$	$\frac{1}{4}$	3.625 = " of $\frac{1}{4}$ box.
		1.8125 = " of $\frac{1}{8}$ box.
		\$63.4375 = " of $8\frac{3}{4}$ boxes. <i>Ans.</i>

(16)

$$20.75 \times 15\frac{1}{2} = \$315.40 \text{ } Ans.$$

		(17)
		124 = cost of 1 ton.
		3
15 cwt.	$\frac{1}{3}$	372 = " of 3 tons.
2 qr.	$\frac{1}{6}$	93 = " of 15 cwt.
10 lb.	$\frac{1}{12}$	3.10 = " of 2 qr.
5 lb.	$\frac{1}{24}$	.62 = " of 10 lb.
		.31 = " of 5 lb.
		\$469.03 = " of 3 T. 15 cwt. 2 qr. 15 lb.

(18)

$$3s. 6d. = 3\frac{1}{2}s.; \quad 350 \times 3\frac{1}{2} = 1225s. = £61 \text{ } 5s. \text{ } Ans.$$

LONGITUDE AND TIME.

(3)

$$\begin{array}{r} 42 \text{ min. } 16 \text{ sec. time.} \\ \underline{15} \\ 10^{\circ} 34' 0'' \text{ long. } Ans. \end{array}$$

(4)

$$\begin{array}{r} 2 \text{ hr. } 20 \text{ min. } 44 \text{ sec. time.} \\ \underline{15} \\ 35^{\circ} 11' 0'' \text{ long. } Ans. \end{array}$$

$$\begin{array}{r}
 (5) \\
 \begin{array}{r}
 12 \text{ hr. } 0 \text{ min. } 0 \text{ sec.} \\
 11 \text{ " } 6 \text{ " } 28 \text{ " } \\
 \hline
 \text{Dif. time } 53 \text{ min. } 32 \text{ sec.} \\
 \hline
 15 \\
 \hline
 13^{\circ} 23' 0'' \text{ long. } \textit{Ans.}
 \end{array}
 \end{array}$$

(1)

$$\begin{aligned}
 89^{\circ} 33' - 74^{\circ} 1' &= 15^{\circ} 32' = \text{diff. long.}; \\
 15^{\circ} 32' \div 15 &= 1 \text{ hr. } 2 \text{ min. } 8 \text{ sec. time}; \\
 12 \text{ hr.} + 1 \text{ hr. } 2 \text{ min. } 8 \text{ sec.} &= 13 \text{ hr. } 2 \text{ min. } 8 \text{ sec.}; \text{ or,} \\
 &2 \text{ min. } 8 \text{ sec. past 1 P. M. } \textit{Ans.}
 \end{aligned}$$

(2)

$$\begin{aligned}
 75^{\circ} 10' - 74^{\circ} 1' &= 1^{\circ} 9' \text{ diff. long.}; \\
 1^{\circ} 9' \div 15 &= 4 \text{ min. } 36 \text{ sec. time}; \\
 3 \text{ hr. } 0 \text{ min. } 0 \text{ sec.} - 4 \text{ min. } 36 \text{ sec.} &= 2 \text{ hr } 55 \text{ min. } 24 \text{ sec. P. M.}
 \end{aligned}$$

(3)

$$\begin{aligned}
 89^{\circ} 2' - 77^{\circ} 2' &= 12^{\circ} \text{ diff. long.}; \quad 12^{\circ} \div 15 = 48 \text{ min. time} \\
 9 \text{ hr. } 0 \text{ min.} - 48 \text{ min.} &= 8 \text{ hr. } 12 \text{ min. A. M. } \textit{Ans.}
 \end{aligned}$$

(4)

$$15^{\circ} 35' \div 15 = 1 \text{ hr. } 2 \text{ min. } 20 \text{ sec. diff. time, too fast. } \textit{Ans.}$$

(1)

$$\begin{aligned}
 2 \text{ hr. } 15 \text{ min. P. M.} &= 14 \text{ hr. } 15 \text{ min. from midnight}; \\
 14 \text{ hr } 15 \text{ min.} - 11 \text{ hr. } 30 \text{ min.} &= 2 \text{ hr. } 45 \text{ min. diff. time}; \\
 2 \text{ hr. } 45 \text{ min.} \times 15 &= 41^{\circ} 15 \text{ min. longitude}; \\
 75^{\circ} 10' - 41^{\circ} 15' &= 33^{\circ} 55' \text{ West. } \textit{Ans.}
 \end{aligned}$$

(2)

$$\begin{aligned}
 10 \text{ hr. } 40 \text{ min.} - 22 \text{ min. } 12 \text{ sec.} &= 10 \text{ hr. } 17 \text{ min. } 48 \text{ sec. P. M., time} \\
 \text{of observation}; \quad 22 \text{ min. } 12 \text{ sec.} \times 15 &= 5^{\circ} 33' \text{ diff. long.}; \\
 90^{\circ} 15' + 5^{\circ} 33' &= 95^{\circ} 48' \text{ West. } \textit{Ans.}
 \end{aligned}$$

(3)

10 hr. 30 min. — 9 hr. 0 min. = 1 hr. 30 min. diff. time ;

1 hr. 30 min. $\times 15 = 22^\circ 30'$; $1^\circ 15' 22'' + 22^\circ 30' = 23^\circ 45' 22''$ West. *Ans.*

(4)

8 hr. $\times 15 = 120^\circ$ diff. long ; $0 + 120^\circ = 120^\circ$ West. *Ans.*

(5)

23 hr. 18 min. 15 sec. — 12 hr. 50 min. 19 sec. = 10 hr. 27 min.

56 sec. diff. time ; 10 hr. 27 min. 56 sec. $\times 15 = 156^\circ 59'$ diff.long. ; or $156^\circ 59'$ East. *Ans.*

APPLICATIONS IN THE FUNDAMENTAL RULES.

(1)

 $96 \times 1.33\frac{1}{3} = \128 *Ans.*

(2)

 $1066 \text{ bu. } 2 \text{ pk.} \div 474 = 2 \text{ bu. } 1 \text{ pk}$

(3)

 $36.00 \div .45 = 80 \text{ bu.} ; 80 \div 2\frac{1}{2} = 160 \div 5 = 32 \text{ bbl.}$

(4)

 $1236 \times 375 + 184 = 463684.$ *Ans.*

(5)

 $60000000 \div 24 \div 60 = 41666\frac{2}{3}$ *Ans.*

(6)

 $23191876 \div 400 = 57979\frac{218}{1000}$ *Ans.*

(7)

2 mo. 3 wk. 6 da. $\times 25 = 74 \text{ mo. } 0 \text{ wk. } 3 \text{ da.} =$ time it willlast 1 man ; $74 \text{ mo. } 0 \text{ wk. } 3 \text{ da.} \div 10 = 7 \text{ mo. } 1 \text{ wk. } 4\frac{1}{2} \text{ da.}$

(8)

$$1200 - 640 = \$560 = \text{amount saved}; 6720 \div 560 = 12 \text{ yr. } \textit{Ans.}$$

(9)

$$20000000 \div 80 = 250000 \text{ min.} = 6 \text{ mo. } 0 \text{ wk. } 5 \text{ da. } 14 \text{ hr. } 40 \text{ min.}$$

(10)

$$47400 \div 3160 = \$15, \text{ price per bbl.}; 11475 \div 15 = 765 \text{ bbl. } \textit{Ans.}$$

(11)

$$96 \times 6 \times .12\frac{1}{2} = \$72 \textit{ Ans.}$$

(12)

$$1000 \times \frac{1}{2} \text{ cent} = 1000 \div 2 = \$5.00 \textit{ Ans.}$$

(13)

$$\$9\frac{1}{2} = \$9.50; 9.50 \times 85\frac{1}{2} = \$812.25 \textit{ Ans.}$$

(14)

$$1 \text{ hhd. } 2 \text{ gal. } 3 \text{ qt.} = 263 \text{ qt.}; 263 \times .56\frac{1}{4} = \$147.9375 \textit{ Ans.}$$

(15)

$$196 \times 1\frac{1}{2} = 294\text{s.} = £14 \text{ 14s. } \textit{Ans.}$$

(16)

$$2\text{s. } 8\text{d.} = 32\text{d.}; 1246 \times 32 = 39872\text{d.} = £166 \text{ 2s. } 8\text{d. } \textit{Ans.}$$

(17)

$$£2 \text{ 16s.} = 56\text{s.}; 56\text{s.} \div 112 = 672\text{d.} \div 112 = 6\text{d. } \textit{Ans.}$$

(18)

$$\$9.75 \div 2 = \$4.87\frac{1}{2}, \text{ price of } \frac{1}{2} \text{ ton or 1000 lb.}$$

$$1426 \times 4.87\frac{1}{2} \div 1000 = \$6.95175 \textit{ Ans.}$$

(19)

$$\$4.50 \div 2 = \$2.25 ; 3840 \times 2.25 \div 1000 = \$8.640 \text{ Ans.}$$

(20)

$$124 \times 2\frac{1}{4} \times \frac{1}{3} = \$93$$

(21)

$$16200 \div (25 \times 18) = 16200 \div 450 = 36$$

(22)

$$10059.28 \div .92 = 10934 \text{ pwt.} = 45 \text{ lb. 6 oz. 14 pwt. Ans.}$$

(23)

$$4200 \div 84 = 50 \text{ Ans.}$$

(24)

$$640 \times 15 = \$9600 = \text{cost of farm ;}$$

$$160 \times 20 = \$3200 = \text{cost of 160 A. ;}$$

$$240 \times 18 = \$4320 = \text{cost of 240 A. ; } 160 + 240 = 400 \text{ A. sold ;}$$

$$3200 \times 4320 \times 4560 = \$12080 = \text{price received for farm ;}$$

$$12080 - 9600 = 2480 = \text{gain ;}$$

$$640 - 400 = 240 ; 4560 \div 240 = \$19, \text{ price per acre. Ans.}$$

(25)

$$2 \text{ walls, each 65 ft. long ; and 2, each 48 ft. long ;}$$

$$65 \times 2 + 48 \times 2 = 226 ; 226 \times 12 \times 2\frac{1}{2} = 6780 \text{ cu. ft. Ans.}$$

(26)

$$325640 \times 2.37\frac{1}{2} \div 1000 = \$773.395 \text{ Ans.}$$

(27)

$$684 \times 6.20 \div 1000 = \$4.2408 \text{ Ans.}$$

(28)

$$786 \times 2.12\frac{1}{2} \div 100 = \$16.7025 \text{ Ans.}$$

(29)

$$40 \times 16 = 640 \text{ sq. ft. in 1 side.}$$

$$640 \times 144 = 9216 \text{ sq. in.}$$

$$92160 \div 24 = 3840 \text{ shingles on one side of the house.}$$

$$3840 \times 2 = 7680 \text{ on both sides. } \textit{Ans.}$$

(30)

$$14 \text{ lb. } 8 \text{ oz. } 12 \text{ pwt. } 3 \text{ qr. } \div 9 = 1 \text{ lb. } 7 \text{ oz. } 12 \text{ pwt. } 11 \text{ gr. } \textit{Ans.}$$

(31)

$$2688 \div 320 = \$8.40 = \text{cost per bbl. ;}$$

$$8.40 \times 1.60 = \$10 = \text{selling price. } \textit{Ans.}$$

(32)

$$449 \text{ bu. } 1 \text{ pk. } 2 \text{ qt. } \div 182 = 2 \text{ bu. } 1 \text{ pk. } 7 \text{ qt. } \textit{Ans.}$$

(33)

$$4875 \div 750 = \$6.50, \text{ cost per bbl. ; } 7.25 - 6.50 = \$0.75, \text{ gain.}$$

(34)

$$169.00 \div 1.625 = 104 \text{ } \textit{Ans.}$$

(35)

$$58 \text{ lb. } \div 3 \text{ lb. } 10 \text{ oz. } = 928 \text{ oz. } \div 58 \text{ oz. } = 16 \text{ } \textit{Ans.}$$

(36)

$$1358 \text{ gal. } 2 \text{ qt. } \div 26 = 52 \text{ gal. } 1 \text{ qt. } \textit{Ans.}$$

(37)

$$3801.65 - 3475.25 = \$326.40, \text{ gain ; } 326.40 \div 3.40 = 96 \text{ } \textit{Ans.}$$

(38)

$$43313281 + 6500000 + 8500000 = 58313281 ;$$

$$58313281 - 57715000 = 598281 \text{ } \textit{Ans.}$$

(39)

12 ft. = 144 in. ; 16 ft. 6 in. = 198 in. ; 264 mi. = 16727040 in. ;
 $16727040 \div 144 = 116160$ times ; $16727040 \div 198 = 84480$ times ;
 $116160 - 84480 = 31680$ times. *Ans.*

(40)

$9 \times 4\frac{1}{3} = 39$ sq. mi. = 24960 acres ; $24960 \div 192 = 130$ *Ans.*

(41)

$4093850 \div 34337 = 119\frac{7747}{34337}$ *Ans.*

(42)

$89^{\circ} 2' - 75^{\circ} 10' = 13^{\circ} 52'$ diff. long. ;
 $13^{\circ} 52' \div 15 = 55$ min. 28 sec. diff. time ;
 12 hr. 0 min. 0 sec. - 55 min. 28 sec. = 11 hr. 4 min. 32 sec. *Ans.*

(43)

8 hr. 30 min. diff. time $\times 15 = 127^{\circ} 30'$ diff. long. *Ans*

(44)

23 min. diff. time $\times 15 = 5^{\circ} 45'$ diff. long. ;
 $73^{\circ} 20' - 5^{\circ} 45' = 67^{\circ} 35' = A$'s longitude ;
 9 hr. 42 min. - 23 min. = 9 hr. 19 min. P. M., B's time. *Ans.*

(45)

120 C. 7 C. ft. 5 cu. ft. $\div 11 = 10$ C. 7 C. ft. 15 cu. ft. *Ans.*

(46)

16 cwt. 2 qr. 11 lb. 10 oz. $\div 9 = 1$ cwt. 3 qr. 9 lb. 10 oz. *Ans.*

(47)

$\$625.40 + \$110.12\frac{1}{2} = \$735.52\frac{1}{2}$; $\$900 - 735.52\frac{1}{2} = \$164.47\frac{1}{2}$

(48)

1775 yr. 4 mo. 19 da.

1492 " 10 " 11 ". 282 yr. 6 mo. 8 da. *Ans.*

(49)

1 pt. 3 gil. \times 18 = 3 gal. 3 qt. 1 pt. 2 gil.6 gal. \times 3 = 18 " 0 " 0 " 0 "2 qt. 1 pt. 3 gil. \times 48 = 34 " 2 " 0 " 0 "

Quantity drawn = 56 gal. 1 qt. 1 pt. 2 gil.

63 gal. - 56 gal. 1 qt. 1 pt. 2 gil. = 6 gal. 2 qt. 0 pt. 2 gil. *Ans.*

(50)

753689 \div 5 $\frac{1}{2}$ = 137034 rd. 2 yd.;137034 \div 40 = 3425 fur. 34 rd.;3425 \div 8 = 428 mi. 1 fur.;428 \div 69 $\frac{1}{8}$ = 6° 13 mi.;6° 13 mi. 1 fur. 34 rd. 2 yd. *Ans.*

(51)

189 mi. 3 fur. = 1515 fur.

1515 fur. 6 rd. = 60606 rd.

60606 rd. 1 ft. = 1000000 ft.

(52)

768 \div 24 = 32 rd. by 1 man ;32 \times 48 = 1536 rd. by 48 men ;1536 \times 9 = 13824 rd. in 9 days. *Ans.*

(53)

7913576 \div 209 = 37864 = sum ; 37864 - 1764 = 36100 *Ans.*

(54)

146 mi. 7 fur. 14 rd. 14 ft. \div 5 = 29 mi. 3 fur. 2 rd. 16 ft. in 1 da.;9 mi. 3 fur. 2 rd. 16 ft. \div 2 = 14 mi. 5 fur. 21 rd. 8 ft. in $\frac{1}{2}$ da.

(55)

17712.50 \div 325 = \$54.50 ; \$545.00 \div 54.50 = 10 acres. *Ans.*

(56)

$4 + 5 = \$9 = \text{cost of one of each ; } 324 \div 9 = 36 \text{ yd. of each.}$

(57)

$68 \text{ yd } 3 \text{ qr. } \div 4 = 17 \text{ yd. } 0 \text{ qr. } 3 \text{ na.} = \text{quantity cut off.}$

$17 \text{ yd. } 0 \text{ qr. } 3 \text{ na. } \div 5 = 3 \text{ yd. } 1 \text{ qr. } 3 \text{ na.} = \text{quantity in a suit.}$

(58)

$\pounds 5 \text{ } 10\text{s.} = 1320\text{d. ; } 18 + 12 + 10 = 40\text{d.} = \text{sum given to one man, woman and boy ; } 1320 \div 40 = 33 \text{ of each class. } \textit{Ans.}$

(59)

$20936468 \div 1585 = 13209\frac{203}{1585} \textit{ Ans.}$

(60)

$6 \text{ doz. dozen} = 864$

$\frac{1}{2} \text{ doz. dozen} = \underline{72}$

$\text{Eggs left} = 792$

$792 \times 1\frac{1}{2} = \$11.88 \textit{ Ans.}$

(61)

$\text{In the 50 years there were 13 leap years ;}$

$365 \times 50 + 13 = 18263 \text{ days in 50 years ;}$

$18263 \times 45 = 821835 \text{ min.} = 1 \text{ yr. } 205 \text{ da. } 17 \text{ hr. } 15 \text{ min. } \textit{A.}$

(62)

$408434 \times 10.25 = 4186448.50 = \text{value of flour ;}$

$2550092 \times 2.12\frac{1}{2} = 5418945.50 = \text{ " of wheat ;}$

$1048540 \times .94 = \underline{985627.60} = \text{ " of corn ;}$

$\textit{Ans. } \$10591021.60 \text{ value of whole.}$

(63)

$1858 \text{ yr. } 1 \text{ mo. } 10 \text{ da. } 15 \text{ hr.} - 1832 \text{ yr. } 6 \text{ mo. } 24 \text{ da. } 6 \text{ hr.} =$

$25 \text{ yr. } 6 \text{ mo. } 16 \text{ da. } 9 \text{ hr. } \textit{Ans.}$

(64)

$85 \times 5 = \$425$; $25 \times 22 = \$550$; $150 \times 2 = \$300$; $5000 + 425 + 550 + 110 + 300 + 45 + 174 + 450 + 380 = \7434 ; $7434 \div 3 = \$2478$, widow's share ; $7434 - 2478 = \$4956$; $4956 \div 4 = \$1239$, each child's share. *Ans.*

(65)

$55 \times 16\frac{1}{2} \times 2 = 1815$ sq. ft. $= 261360$ sq. in. $=$ surface of two sides of roof ; $\frac{1}{2}$ of 15 in. $= 5$ in. ; $5 \times 4 = 20$ sq. in. ; $261360 + 20 = 13068$ shingles. *Ans.*

(66)

$77^\circ 2'$ West $+ 30^\circ 45'$ East $= 107^\circ 47'$ diff. long. ;
 $107^\circ 47' \div 15 = 7$ hr. 11 min. 8 sec. diff. time ;
 6 hr. $+ 7$ hr. 11 min. 8 sec. $= 13$ hr. 11 min. 8 sec. ; or,
 1 hr. 11 min. 8 sec. P. M. *Ans.*

(67)

1 hr. 44 min. $\times 15 = 26^\circ 0'$ diff. long. ; or the place is 26° East of New York ; 3 hr. 12 min. $+ 1$ hr. 44 min. $= 4$ hr. 56 min. P. M., time. *Ans.*

(68)

$45 - 25 = 20$ gal. left in cistern every hour ;
 $960 \div 20 = 48$ hr. $=$ time to fill it. *Ans.*

(69)

$6500500 \times .50 = \$3250250$; $3250250 \div 750 = 4333\frac{2}{3}$ *Ans.*

(70)

$2180 - 500 = \$1680$; $1680 \div 840 = \$2$. *Ans.*

(71)

$.37\frac{1}{2} \times 30 = \11.25 , value of potatoes ; $.45 \times 6 = \$2.70$, value of molasses ; $.06\frac{1}{2} \times 60 = \3.90 , value of mackerel ; $2.70 + 3.90 = \$6.60$; $11.25 - 6.60 = \$4.65$; $4.65 \div .10 = 46\frac{1}{2}$ lb. *A.*

(72)

174 mi. 1 fur. \div 12 mi. 3 fur. 20 rd. $= 55720 \div 3980 = 14$ days.

(73)

2 bbl. 12 gal. 2 qt. $\times 12 = 28$ bbl. 6 gal

(74)

550 pt. $= 2$ bbl. 5 gal. 3 qt. ; 400 qt. $= 3$ bbl. 5 gal. 2 qt. ;
 350 two quarts $= 5$ bbl. 17 gal. 2 qt. ; 375 three quarts $= 8$ bbl.
 29 gal. 1 qt. ; 150 gal. $= 4$ bbl. 24 gal. ; 2 bbl. 5 gal. 3 qt. +
 3 bbl. 5 gal. 2 qt. + 5 bbl. 17 gal. 2 qt. + 8 bbl. 29 gal. 1 qt. +
 4 bbl. 24 gal. $= 24$ bbl. 19 gal. *Ans.*

(75)

$18 \times 16 = 288$ sq. ft. ; $288 \times 2 = 576$ sq. ft. in both ; $576 \div 9 =$
 64 sq. yd. ; $64 \times \$1.33\frac{1}{3} = \$85.33\frac{1}{3}$ *Ans.*

(76)

$22 \times 2 = 44$; $16 \times 2 = 32$; $44 + 32 = 76$ ft. ; $76 \times 9 = 684$ sq. ft. ;
 10 yd. $= 30$ ft. ; $30 \times 2 = 60$ sq. ft. ; 684 sq. ft. $\div 60$ sq. ft. $=$
 $11\frac{3}{5}$ rolls. *Ans.*

(77)

1 mi. 4 fur. 20 rd. $= 500$ rd. If to gain 5 rods he must travel
 25 rods, to gain 500 rods he must travel as many times
 25 rods as 5 rods is contained times in 500 rods, which is
 100 ; therefore, he must travel 100 times 25 rods $= 2500$
 rods $= 7$ mi. 6 fur. 20 rd. *Ans.*

(78)

$\$1.75 \times 500 = \875.00 ; $875.00 \div .05 = 17500$ lb.;
 $17500 \div 2 = 8750$ lb. sold = quantity left. *Ans.*

(79)

$\$12.875 \times 7 = \90.125 , cost of the whole ; $7 - 2 = 5$;
 $\$90.125 \div 5 = \18.025 , what he received per barrel.

(80)

$\$26250 - \$18750 = \$7500$, whole gain ;
 $7500 \div 3 = 2500$ barrels. *Ans.*

(81)

$(964 \text{ bu. } 2 \text{ pk. } 4 \text{ qt.}) \div 2 = 482 \text{ bu. } 1 \text{ pk. } 2 \text{ qt.}$ the first one's share ;
 $(482 \text{ bu. } 1 \text{ pk. } 2 \text{ qt.}) \div 3 = 160 \text{ bu. } 3 \text{ pk. } 0 \text{ qt. } 1\frac{1}{3} \text{ pt.}$ 2d one's share ;
 $482 \text{ bu. } 1 \text{ pk. } 2 \text{ qt.} + 160 \text{ bu. } 3 \text{ pk. } 0 \text{ qt. } 1\frac{1}{3} \text{ pt.} = 643 \text{ bu. } 0 \text{ pk. } 2 \text{ qt. } 1\frac{1}{3} \text{ pt.}$;
 $964 \text{ bu. } 2 \text{ pk. } 4 \text{ qt.} - 643 \text{ bu. } 0 \text{ pk. } 2 \text{ qt. } 1\frac{1}{3} \text{ pt.} = 321 \text{ bu } 2 \text{ pk. } 1 \text{ qt. } \frac{2}{3} \text{ pt.}$, third share.

(82)

$70^{\circ} 25'$	$105^{\circ} 30' 56''$	$156^{\circ} 26' 36''$
$46^{\circ} 50'$	$10^{\circ} 5' 40''$	$115^{\circ} 36' 36''$
$39^{\circ} 11' 36''$	$115^{\circ} 36' 36''$ West.	$40^{\circ} 50' 00''$ E.
$156^{\circ} 26' 36''$ E.		

$40^{\circ} 50' + 77^{\circ} = 117^{\circ} 50' = 7070'$; $3^{\circ} 20' = 200'$; $7070' \div 200' = 35\frac{7}{10}$ days. *Ans.*

(83)

$\$25000 \div 125 = \200 , one share ; $\$200 \times 12 = \2400 , Captain's share ; $\$200 \times 2 \times 5 = \2000 , the Lieutenants' shares ; $\$200 \times 6 \times 3 = \3600 , the Midshipmen's shares ; $2400 + 2000 + 3600 = \$8000$; $25000 - 8000 = \$17000$; $\$17000 \div 85 = \200 , each sailor's share. *Ans.*

(84)

1 hr. 5 min. 44 sec. $\times 15 = 16^{\circ} 26' 0''$ diff. long. ;
 $71^{\circ} 4' + 16^{\circ} 26' = 87^{\circ} 30'$ long. of Chicago. *Ans.*

(85)

8 hr. 27 min. 30 sec. + 1 hr. 5 m. 44 sec. = 9 hr. 33 m. 14 sec. *A. M.*

(86)

12 hr. 0 min. 0 sec. - 1 hr. 5 m. 44 sec. = 10 hr. 54 m. 16 sec. *A. M.*

(87)

1 hr. 16 min. $\times 15 = 19^{\circ} 0' 0''$ *Ans.*

(88)

$20 \times 16 \times 12 = 3840$ E. E. ; $3840 \times 5 \div 4 = 4800$ yd. *Ans.*

(89)

$8968 + 1060 = \$10028 =$ price for the whole ;
 $10028 - 2618 = \$7410 =$ price at which he must sell the
 remainder.

(90)

24 lb. 4 oz. 6 pwt. 18 gr. $\div 11$ pwt. 9 gr. = 140322 gr. $\div 273$ gr. =
 514 *Ans.*

(91)

$740 \times 2 = \$1480$; $3284.82 - 1480 = \$1804.82 =$ value at \$1.42 ;
 $1804.82 \div 1.42 = 1271$ bu. ; $1271 + 740 = 2011$ bu.

(92)

105 A. 2 R. 20 P. = 16900 P., whose value, at \$1, is \$16900 ;
 its payment will require 16900 hours = 1 yr. 338 da. 22 hr.

(93)

 $98 + 46 = 144 = \text{twice the larger number ;}$ $144 \div 2 = 72 = \text{larger number ; } 72 - 46 = 26 = \text{smaller. } \textit{Ans.}$

(94)

 $190 - 76 = \$114 = \text{twice the value of the cow ;}$ $\frac{1}{2} \text{ of } \$114 = \$57 = \text{value of cow ; } 57 + 76 = \$133 = \text{val. of horse.}$

(95)

27 days in March.

30 " " April.

31 " " May.

30 " " June.

31 " " July.

21 " " August.170 days. *Ans.*

(96)

 $870 \times 9\frac{1}{2} = \$8265, \text{ whole cost ;}$ $8265 \div 2 = \$4132.50, \text{ half cost ;}$ $\frac{1}{4} \text{ of } 4132.50 = 1033.12\frac{1}{2} = \text{loss ;}$ $870 \div 2 = 435, \text{ quantity injured ;}$ $435 \text{ bbl.} = 435 \times 2 = 870 \frac{1}{2} \text{ bbl. ;}$ $1033.12\frac{1}{2} \div 870 = \$1.1875 \text{ } \textit{Ans.}$

(97)

 $675 + 812 = \$1487 = \text{amount for extra services ;}$ $24612 - 1487 = \$23125 = \text{amount to be equally divided ;}$ $23125 \div 3 = \$7708.33\frac{1}{3}, \text{ C's share ; } 7708.33\frac{1}{3} + 675 = \$8383.33\frac{1}{3},$ $\text{A's share ; } 7708.33\frac{1}{3} + 812 = \$8520.33\frac{1}{3}, \text{ B's share.}$

(98)

 $6750 + 3500 + 156 + 364 = \$10770 = \text{expenses ;}$ $250 + 175 + 95 = \underline{520} = \text{allowances ;}$ $\$11290 = \text{deduction.}$ $56895 - 11290 = \$45605, \text{ net profit ;}$ $45605 \div 4 = \$11401.25 - \text{share of 4th ;}$ $11401.25 + 250 = \$11651.25 - \text{1st ;}$ $11401.25 + 175 = \$11576.25 - \text{2d ;}$ $11401.25 + 95 = \$11496.25 - \text{3d.}$

PROPERTIES OF NUMBERS.

(1)

$\begin{array}{r} 3 \overline{)9} \\ 3 \overline{)3} \\ 1 \end{array}$	..	$\begin{array}{r} 2 \overline{)10} \\ 5 \overline{)5} \\ 1 \end{array}$	..	$\begin{array}{r} 2 \overline{)12} \\ 2 \overline{)6} \\ 3 \end{array}$	..	$\begin{array}{r} 2 \overline{)14} \\ 7 \\ 2 \text{ and } 7 \end{array}$	..	$\begin{array}{r} 2 \overline{)16} \\ 2 \overline{)8} \\ 2 \overline{)4} \\ 2 \end{array}$
3 and 3	..	2 and 5	..	2, 2, and 3				2, 2, 2 & 2

$\begin{array}{r} 2 \overline{)18} \\ 3 \overline{)9} \\ 3 \end{array}$	..	$\begin{array}{r} 2 \overline{)24} \\ 2 \overline{)12} \\ 2 \overline{)6} \\ 3 \end{array}$	..	$\begin{array}{r} 3 \overline{)27} \\ 3 \overline{)9} \\ 3 \end{array}$	..	$\begin{array}{r} 2 \overline{)28} \\ 2 \overline{)14} \\ 7 \end{array}$
2, 3 and 3		3		3, 3 and 3	..	2, 2 and 7
		2, 2, 2 and 3				

(2)

$\begin{array}{r} 2 \overline{)30} \\ 3 \overline{)15} \\ 5 \end{array}$	..	$\begin{array}{r} 2 \overline{)22} \\ 11 \\ 2 \text{ and } 11 \end{array}$	..	$\begin{array}{r} 2 \overline{)32} \\ 2 \overline{)16} \\ 2 \overline{)8} \\ 2 \overline{)4} \\ 2 \end{array}$	..	$\begin{array}{r} 2 \overline{)36} \\ 2 \overline{)18} \\ 3 \overline{)9} \\ 3 \end{array}$
2, 3 and 5				2, 2, 2 and 2		2, 2, 3 and 3

$\begin{array}{r} 2 \overline{)38} \\ 19 \\ 2 \text{ and } 19 \end{array}$	..	$\begin{array}{r} 2 \overline{)40} \\ 2 \overline{)20} \\ 2 \overline{)10} \\ 5 \end{array}$	..	$\begin{array}{r} 5 \overline{)45} \\ 3 \overline{)9} \\ 3 \end{array}$	..	$\begin{array}{r} 7 \overline{)49} \\ 7 \\ 7 \text{ and } 7 \end{array}$
		2, 2, 2 and 5		5, 3 and 3		

(3)

$\begin{array}{r} 2 \overline{)50} \\ 5 \overline{)25} \\ 5 \end{array}$	..	$\begin{array}{r} 2 \overline{)56} \\ 2 \overline{)28} \\ 2 \overline{)14} \\ 7 \end{array}$	..	$\begin{array}{r} 2 \overline{)58} \\ 29 \\ 2 \text{ and } 29 \end{array}$	..	$\begin{array}{r} 2 \overline{)60} \\ 2 \overline{)30} \\ 3 \overline{)15} \\ 5 \end{array}$	..	$\begin{array}{r} 2 \overline{)64} \\ 2 \overline{)32} \\ 2 \overline{)16} \\ 2 \overline{)8} \\ 2 \end{array}$
2, 5 and 5		2, 2, 2 and 7				2, 2, 3 and 5		2, 2, 2, 2 and 2

$\begin{array}{r} 2 \overline{)66} \\ 11 \overline{)33} \\ 3 \end{array}$	..	$\begin{array}{r} 2 \overline{)68} \\ 2 \overline{)34} \\ 17 \end{array}$	..	$\begin{array}{r} 2 \overline{)70} \\ 7 \overline{)35} \\ 5 \end{array}$	..	$\begin{array}{r} 2 \overline{)72} \\ 2 \overline{)36} \\ 2 \overline{)18} \\ 3 \overline{)9} \\ 3 \end{array}$
2, 11 and 3	..	2, 2 and 17	..	2, 7 and 5		2, 2, 2, 3 and 3

(4)

$\begin{array}{r} 2 \overline{)76} \\ 2 \overline{)38} \\ 19 \end{array}$	..	$\begin{array}{r} 2 \overline{)78} \\ 3 \overline{)39} \\ 13 \end{array}$	..	$\begin{array}{r} 2 \overline{)80} \\ 2 \overline{)40} \\ 2 \overline{)20} \\ 2 \overline{)10} \\ 5 \end{array}$	..	$\begin{array}{r} 2 \overline{)82} \\ 41 \\ 2 \text{ and } 41 \end{array}$
2, 2 and 19	..	2, 3 and 13		2, 2, 2, 2, and 5		

$\begin{array}{r} 2 \overline{)84} \\ 2 \overline{)42} \\ 3 \overline{)21} \\ 7 \end{array}$	..	$\begin{array}{r} 2 \overline{)86} \\ 43 \\ 2 \text{ and } 43 \end{array}$	..	$\begin{array}{r} 2 \overline{)88} \\ 2 \overline{)44} \\ 2 \overline{)22} \\ 11 \end{array}$	..	$\begin{array}{r} 2 \overline{)90} \\ 5 \overline{)45} \\ 3 \overline{)9} \\ 3 \end{array}$
2, 2, 3 and 7				2, 2, 2 and 11	..	2, 5, 3 and 3

(5)

$\begin{array}{r} 2)100 \\ 2)50 \\ 5)25 \\ \hline 5 \end{array}$	..	$\begin{array}{r} 2)102 \\ 3)51 \\ 17 \end{array}$	..	$\begin{array}{r} 2)104 \\ 2)52 \\ 2)26 \\ \hline 13 \end{array}$	..	$\begin{array}{r} 5)275 \\ 5)55 \\ 11 \end{array}$
2, 2, 5 and 5		2, 3 and 17		2, 2, 2, and 13		5, 5 and 11
$\begin{array}{r} 2)960 \\ 2)480 \\ 2)240 \\ 2)120 \\ 2)60 \\ 2)30 \\ 3)15 \\ \hline 5 \end{array}$	..	$\begin{array}{r} 2)472 \\ 2)236 \\ 2)118 \\ 59 \end{array}$	..	$\begin{array}{r} 2)160 \\ 2)80 \\ 2)40 \\ 2)20 \\ 2)10 \\ 5 \end{array}$	..	$\begin{array}{r} 2)836 \\ 2)418 \\ 11)209 \\ 19 \end{array}$
2, 2, 2, 2, 2, 2, 3 & 5		2, 2, 2 and 59		2, 2, 2, 2, 2 & 5		2, 2, 11 & 19

(6)

$\begin{array}{r} 5)105 \\ 3)21 \\ 7 \end{array}$	..	$\begin{array}{r} 2)106 \\ 53 \end{array}$	..	$\begin{array}{r} 2)108 \\ 2)54 \\ 3)27 \\ 3)9 \\ 3 \end{array}$	..	$\begin{array}{r} 2)110 \\ 5)55 \\ 11 \end{array}$	..	$\begin{array}{r} 5)115 \\ 23 \end{array}$
5, 3 and 7		2 and 53		2, 5 and 11		5 and 23		

2, 2, 3, 3 & 3

<u>2)116</u>	..	<u>2)120</u>	..	<u>5)125</u>	..	<u>5)1125</u>	..	<u>2)360</u>
<u>2)58</u>		<u>2)60</u>		<u>5)25</u>		<u>5)225</u>		<u>2)180</u>
29		<u>2)30</u>		5		<u>5)45</u>		<u>2)90</u>
2, 2 & 29		<u>3)15</u>		5, 5 and 5		<u>3)9</u>		<u>5)45</u>
		5				3		<u>3)9</u>
		2, 2, 2, 3 & 5				5, 5, 5, 3 & 3		3
								2, 2, 2, 5, 3 & 3

$$\begin{array}{r}
 (1) \\
 5 \overline{) 150 \cdot 210 \cdot 270} \\
 3 \overline{) 30 \cdot 42 \cdot 54} \\
 2 \overline{) 10 \cdot 14 \cdot 18} \\
 5 \cdot 7 \cdot 9
 \end{array}$$

5, 3 & 2 are the c. p. f.

$$\begin{array}{r}
 (2) \\
 2 \overline{) 42 \cdot 126 \cdot 168} \\
 3 \overline{) 21 \cdot 63 \cdot 84} \\
 7 \overline{) 7 \cdot 21 \cdot 28} \\
 1 \cdot 3 \cdot 4
 \end{array}$$

2, 3 & 7 are c. p. f.

$$\begin{array}{r}
 (3) \\
 5 \overline{) 105 \cdot 315 \cdot 525} \\
 3 \overline{) 21 \cdot 63 \cdot 105} \\
 7 \overline{) 7 \cdot 21 \cdot 35} \\
 1 \cdot 3 \cdot 5
 \end{array}$$

5, 3 & 7 are c. p. f.

$$\begin{array}{r}
 (4) \\
 2 \overline{) 84 \cdot 126 \cdot 210} \\
 3 \overline{) 42 \cdot 63 \cdot 105} \\
 7 \overline{) 14 \cdot 21 \cdot 35} \\
 2 \cdot 3 \cdot 5
 \end{array}$$

2, 3 and 7 are c. p. f.

$$\begin{array}{r}
 (5) \\
 2 \overline{) 168 \cdot 256 \cdot 410 \cdot 820} \\
 84 \cdot 128 \cdot 205 \cdot 410 \\
 2 \text{ is the c. p. f.}
 \end{array}$$

CANCELLATION.

$$\begin{array}{r}
 (1) \\
 \begin{array}{c} 2 \\ 2 \times 4 \times 8 \times 13 \times 7 \times 16 \end{array} = 32 \text{ Ans.} \\
 \begin{array}{c} 2 \times 4 \times 8 \\ 13 \quad 2 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (2) \\
 \begin{array}{c} 3 \quad 5 \quad 2 \\ 42 \times 3 \times 25 \times 12 \end{array} = \frac{15}{4} = 3\frac{3}{4} \\
 \begin{array}{c} 28 \times 4 \times 15 \times 6 \\ 4 \quad 2 \quad 3 \\ 2
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (3) \\
 \begin{array}{c} 5 \quad 2 \quad 14 \\ 125 \times 60 \times 24 \times 42 \end{array} = 14 \text{ Ans.} \\
 \begin{array}{c} 25 \times 120 \times 30 \times 6 \\ 2 \quad 3
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (4) \\
 \begin{array}{c} 4 \quad 6 \quad 2 \\ 44 \times 18 \times 26 \times 14 \end{array} = 48 \text{ Ans.} \\
 \begin{array}{c} 11 \times 39 \times 7 \times 2 \\ 3
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (5) \\
 \begin{array}{c} 40 \quad 2 \quad 2 \\ 240 \times 8 \times 114 \times 5 \end{array} = \frac{80}{3} = 8\frac{8}{3} \\
 \begin{array}{c} 57 \times 24 \times 15 \times 6 \\ 6 \quad 3 \quad 3
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (6) \\
 \begin{array}{c} 2 \quad 7 \\ 40 \times 49 \end{array} = \frac{1}{3} = 4\frac{2}{3} \\
 \begin{array}{c} 21 \times 23 \\ 3
 \end{array}
 \end{array}$$

C*

(7)

$$\begin{array}{r} 2 \quad 4 \\ 192 \times 68 \\ \hline 96 \times 22 \end{array} = 8 \text{ Ans.}$$

(8)

$$\begin{array}{r} 7 \\ 14 \quad 4 \\ 42 \times 72 \\ \hline 40 \times 10 \times 27 \\ 5 \quad 9 \end{array} = 7 \frac{1}{5} \text{ Ans.}$$

(9)

$$\begin{array}{r} 16 \quad 7 \\ 48 \quad 40 \quad 2 \\ 240 \times 441 \times 16 \\ \hline 175 \times 56 \times 27 \\ 35 \quad 7 \quad 3 \\ 5 \end{array} = 32 = 6 \frac{2}{3} \text{ Ans.}$$

(10)

$$\begin{array}{r} 3 \\ 21 \quad 2 \\ 840 \times 64 \times 124 \times 9 \\ \hline 560 \times 32 \times 31 \times 4 \\ 14 \end{array} = 27 \text{ Ans.}$$

(11)

$$\begin{array}{r} 9 \\ 7 \times 18 \\ \hline 14 \end{array} = 9 \text{ Ans.}$$

(12)

$$\begin{array}{r} 4 \\ 9 \times 40 \times 5 \\ \hline 50 \end{array} = 36$$

(13)

$$\begin{array}{r} 46 \\ 1.84 \times 12 \\ \hline .48 \\ 4 \end{array} = 46$$

(14)

$$\begin{array}{r} 7 \\ 8 \times 175 \times 4 \\ \hline 25 \times 56 \end{array} = 4 \text{ Ans.}$$

(15)

$$\begin{array}{r} 5 \\ 20 \times 10 \\ \hline 12 \quad 3 \end{array} = \frac{50}{3} = 16 \frac{2}{3} \text{ Ans.}$$

(16)

$$\begin{array}{r} 3 \quad 8 \\ 1050 \times 96 \\ \hline 350 \times 36 \end{array} = 8 \text{ Ans.}$$

(17)

$87 + 60 + 45 = 192 = \text{value of one of each.}$

$$\begin{array}{r} 23 \quad 41 \\ 184 \times 492 \\ \hline 192 \quad 2 \\ 162 \end{array} = \frac{943}{2} = 471 \frac{1}{2} \text{ Ans.}$$

(18)

$$\begin{array}{r} 3 \quad 5 \\ 42 \times 250 \\ \hline 700 \quad 50 \end{array} = 15 \text{ Ans.}$$

(19)

$$\begin{array}{r} 621 \quad 10 \\ 2484 \times 120 \\ \hline .48 \quad 4 \end{array} = 6210 \text{ Ans.}$$

(20)

$$\begin{array}{r} 3 \\ 9 \times 12 \\ 16 \\ 4 \end{array} = \frac{27}{4} = 6\frac{3}{4} \text{ Ans.}$$

(21)

$$\begin{array}{r} 5 \quad 7 \\ 10 \times 14 \times 6 \\ 18 \\ 8 \\ 4 \\ 2 \end{array} = \frac{35}{2} = 17\frac{1}{2} \text{ Ans.}$$

(22)

$$\begin{array}{r} 3 \\ 27 \times 15 \\ 36 \\ 4 \end{array} = \frac{45}{4} = 11\frac{1}{4} \text{ Ans.}$$

(23)

$$\begin{array}{r} 9 \quad 3 \\ 15 \times 3 \times 12 \times 4 \\ 72 \times 20 \\ 8 \quad 5 \\ 2 \end{array} = \frac{9}{2} = 4\frac{1}{2} \text{ Ans.}$$

LEAST COMMON MULTIPLE.

(1)

$$\begin{array}{r} 2) 4 \dots 9 \dots 10 \dots 15 \dots 18 \dots 20 \dots 21 \\ 2) 2 \dots 9 \dots 5 \dots 15 \dots 9 \dots 10 \dots 21 \\ 3) 1 \dots 9 \dots 5 \dots 15 \dots 9 \dots 5 \dots 21 \\ 3) 1 \dots 3 \dots 5 \dots 5 \dots 3 \dots 5 \dots 7 \\ 5) 1 \dots 1 \dots 5 \dots 5 \dots 1 \dots 5 \dots 7 \\ 1 \dots 1 \dots 1 \dots 1 \dots 1 \dots 1 \dots 7 \\ 2 \times 2 \times 3 \times 3 \times 5 \times 7 = 1260 \text{ Ans.} \end{array}$$

(2)

$$\begin{array}{r} 2) 8 \dots 9 \dots 10 \dots 12 \dots 25 \dots 32 \dots 75 \dots 80 \\ 2) 4 \dots 9 \dots 5 \dots 6 \dots 25 \dots 16 \dots 75 \dots 40 \\ 2) 2 \dots 9 \dots 5 \dots 3 \dots 25 \dots 8 \dots 75 \dots 20 \\ 2) 1 \dots 9 \dots 5 \dots 3 \dots 25 \dots 4 \dots 75 \dots 10 \\ 3) 1 \dots 9 \dots 5 \dots 3 \dots 25 \dots 2 \dots 75 \dots 5 \\ 5) 1 \dots 3 \dots 5 \dots 1 \dots 25 \dots 2 \dots 25 \dots 5 \\ 5) 1 \dots 3 \dots 1 \dots 1 \dots 5 \dots 2 \dots 5 \dots 1 \\ 1 \dots 3 \dots 1 \dots 1 \dots 1 \dots 2 \dots 1 \dots 1 \\ 2 \times 2 \times 2 \times 2 \times 3 \times 5 \times 5 \times 3 \times 2 = 7200 \text{ Ans.} \end{array}$$

(3)

$$\begin{array}{r} 2) 1 \dots 2 \dots 3 \dots 4 \dots 5 \dots 6 \dots 7 \dots 9 \\ \hline \end{array}$$

$$\begin{array}{r} 3) 1 \dots 1 \dots 3 \dots 2 \dots 5 \dots 3 \dots 7 \dots 9 \\ \hline \end{array}$$

$$\begin{array}{r} 1 \dots 1 \dots 1 \dots 2 \dots 5 \dots 1 \dots 7 \dots 3 \\ \hline \end{array}$$

$$2 \times 3 \times 2 \times 5 \times 7 \times 3 = 1260 \text{ Ans.}$$

(4)

$$\begin{array}{r} 2) 9 \dots 16 \dots 42 \dots 63 \dots 21 \dots 14 \dots 72 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 9 \dots 8 \dots 21 \dots 63 \dots 21 \dots 7 \dots 36 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 9 \dots 4 \dots 21 \dots 63 \dots 21 \dots 7 \dots 18 \\ \hline \end{array}$$

$$\begin{array}{r} 3) 9 \dots 2 \dots 21 \dots 63 \dots 21 \dots 7 \dots 9 \\ \hline \end{array}$$

$$\begin{array}{r} 3) 3 \dots 2 \dots 7 \dots 21 \dots 7 \dots 7 \dots 3 \\ \hline \end{array}$$

$$\begin{array}{r} 7) 1 \dots 2 \dots 7 \dots 7 \dots 7 \dots 7 \dots 1 \\ \hline \end{array}$$

$$\begin{array}{r} 1 \dots 2 \dots 1 \dots 1 \dots 1 \dots 1 \dots 1 \\ \hline \end{array}$$

$$2 \times 2 \times 2 \times 3 \times 3 \times 7 \times 2 = 1008 \text{ Ans.}$$

(5)

$$\begin{array}{r} 5) 7 \dots 15 \dots 21 \dots 28 \dots 35 \dots 100 \dots 125 \\ \hline \end{array}$$

$$\begin{array}{r} 5) 7 \dots 3 \dots 21 \dots 28 \dots 7 \dots 20 \dots 25 \\ \hline \end{array}$$

$$\begin{array}{r} 7) 7 \dots 3 \dots 21 \dots 28 \dots 7 \dots 4 \dots 5 \\ \hline \end{array}$$

$$\begin{array}{r} 3) 1 \dots 3 \dots 3 \dots 4 \dots 1 \dots 4 \dots 5 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 1 \dots 1 \dots 1 \dots 4 \dots 1 \dots 4 \dots 5 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 1 \dots 1 \dots 1 \dots 2 \dots 1 \dots 2 \dots 5 \\ \hline \end{array}$$

$$\begin{array}{r} 1 \dots 1 \dots 1 \dots 1 \dots 1 \dots 1 \dots 5 \\ \hline \end{array}$$

$$5 \times 5 \times 7 \times 3 \times 2 \times 2 \times 5 = 10500 \text{ Ans.}$$

(6)

2)	15	..	16	..	18	..	20	..	24	..	25	..	27	..	30
2)	15	..	8	..	9	..	10	..	12	..	25	..	27	..	15
2)	15	..	4	..	9	..	5	..	6	..	25	..	27	..	15
3)	15	..	2	..	9	..	5	..	3	..	25	..	27	..	15
3)	5	..	2	..	3	..	5	..	1	..	25	..	9	..	5
5)	5	..	2	..	1	..	5	..	1	..	25	..	3	..	5
	1	..	2	..	1	..	1	..	1	..	5	..	3	..	1
$2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 2 \times 5 \times 3 = 10800$ Ans.															

(7)

2)	9	..	18	..	27	..	36	..	45	..	54
3)	9	..	9	..	27	..	18	..	45	..	27
3)	3	..	3	..	9	..	6	..	15	..	9
3)	1	..	1	..	3	..	2	..	5	..	3
	1	..	1	..	1	..	2	..	5	..	1
$2 \times 3 \times 3 \times 3 \times 2 \times 5 = 540$ Ans.											

(8)

2)	4	..	10	..	14	..	15	..	21
5)	2	..	5	..	7	..	3	..	21
7)	2	..	1	..	7	..	3	..	21
3)	2	..	1	..	1	..	3	..	3
	2	..	1	..	1	..	1	..	1
$2 \times 5 \times 7 \times 3 \times 2 = 420$ Ans.									

(9)

$$\begin{array}{r} 2 \overline{) 7 \dots 14 \dots 16 \dots 21 \dots 24} \end{array}$$

$$\begin{array}{r} 2 \overline{) 7 \dots 7 \dots 8 \dots 21 \dots 12} \end{array}$$

$$\begin{array}{r} 2 \overline{) 7 \dots 7 \dots 4 \dots 21 \dots 6} \end{array}$$

$$\begin{array}{r} 3 \overline{) 7 \dots 7 \dots 2 \dots 21 \dots 3} \end{array}$$

$$\begin{array}{r} 7 \overline{) 7 \dots 7 \dots 2 \dots 7 \dots 1} \end{array}$$

$$1 \dots 1 \dots 2 \dots 1 \dots 1$$

$$2 \times 2 \times 2 \times 3 \times 7 \times 2 = 336 \text{ Ans.}$$

(10)

$$\begin{array}{r} 7 \overline{) 49 \dots 14 \dots 84 \dots 168 \dots 98} \end{array}$$

$$\begin{array}{r} 7 \overline{) 7 \dots 2 \dots 12 \dots 24 \dots 14} \end{array}$$

$$\begin{array}{r} 2 \overline{) 1 \dots 2 \dots 12 \dots 24 \dots 2} \end{array}$$

$$\begin{array}{r} 2 \overline{) 1 \dots 1 \dots 6 \dots 12 \dots 1} \end{array}$$

$$\begin{array}{r} 3 \overline{) 1 \dots 1 \dots 3 \dots 6 \dots 1} \end{array}$$

$$1 \dots 1 \dots 1 \dots 2 \dots 1$$

$$7 \times 7 \times 2 \times 2 \times 3 \times 2 = 1176 \text{ Ans.}$$

(11)

$$\begin{array}{r} 2 \overline{) 9 \dots 12 \dots 16} \end{array}$$

$$\begin{array}{r} 2 \overline{) 9 \dots 6 \dots 8} \end{array}$$

$$\begin{array}{r} 3 \overline{) 9 \dots 3 \dots 4} \end{array}$$

$$3 \dots 1 \dots 4$$

$$2 \times 2 \times 3 \times 3 \times 4 = 144 \text{ rods of ditch.}$$

$$144 \div 9 = 16 \text{ days} = \text{A's time.}$$

$$144 \div 12 = 12 \text{ " } = \text{B's "}$$

$$144 \div 16 = 9 \text{ " } = \text{C's "}$$

(12)

$$\begin{array}{r} 2 \overline{) 15 \dots 16 \dots 21 \dots 24} \end{array}$$

$$\begin{array}{r} 2 \overline{) 15 \dots 8 \dots 21 \dots 12} \end{array}$$

$$\begin{array}{r} 2 \overline{) 15 \dots 4 \dots 21 \dots 6} \end{array}$$

$$\begin{array}{r} 3 \overline{) 15 \dots 2 \dots 21 \dots 3} \end{array}$$

$$5 \dots 2 \dots 7 \dots 1$$

$$2 \times 2 \times 2 \times 3 \times 5 \times 2 \times 7 = 1680$$

The L. C. M., \$1680, is the least amount that will exactly pay either class of the workmen.

$$1680 \div 15 = 112 \text{ men in 1st class.}$$

$$1680 \div 16 = 105 \text{ " " 2d "}$$

$$1680 \div 21 = 80 \text{ " " 3d "}$$

$$1680 \div 24 = 70 \text{ " " 4th "}$$

(13)

$$\begin{array}{r} 3 \overline{) 2 \cdot 3 \cdot 7 \cdot 15} \\ 2 \cdot 1 \cdot 7 \cdot 5 \end{array}$$
 The L. C. M., 210 bu., is the least number that will exactly fill either class.

$3 \times 2 \times 7 \times 5 = 210$ $210 \div 2 = 105$ bags ; $210 \div 3 = 70$ bbl ;
 $210 \div 7 = 30$ boxes ; $210 \div 15 = 14$ hhd.

(14)

Find the number of days required by each to perform the circuit. The lowest common multiple of these numbers will be the number of days required for them to meet at the same point.

$300 \div 15 = 20$ da. = A's time.

$300 \div 20 = 15$ da. = B's "

$300 \div 25 = 12$ da. = C's "

$300 \div 30 = 10$ da. = D's "

In 60 days will be traveled, by

A, $15 \times 60 = 900$ mi. = 3 circuits.

B, $20 \times 60 = 1200$ mi. = 4 "

C, $25 \times 60 = 1500$ mi. = 5 "

D, $30 \times 60 = 1800$ mi. = 6 "

$$\begin{array}{r} 2 \overline{) 10 \cdot 12 \cdot 15 \cdot 20} \\ 2 \cdot 5 \cdot 6 \cdot 15 \cdot 10 \end{array}$$

$$\begin{array}{r} 3 \overline{) 5 \cdot 8 \cdot 15 \cdot 5} \\ 5 \cdot 1 \cdot 5 \cdot 5 \end{array}$$

$$\begin{array}{r} 5 \overline{) 5 \cdot 1 \cdot 5 \cdot 5} \\ 1 \cdot 1 \cdot 1 \cdot 1 \end{array}$$

$$\begin{array}{r} 5 \overline{) 5 \cdot 1 \cdot 5 \cdot 5} \\ 1 \cdot 1 \cdot 1 \cdot 1 \end{array}$$

$1 \cdot 1 \cdot 1 \cdot 1$

$2 \times 2 \times 3 \times 5 = 60$ da.

GREATEST COMMON DIVISOR.

(2)

$18 = 2 \times 3 \times 3$

$36 = 2 \times 3 \times 3 \times 2$

2, 3 and 3 are common.

$2 \times 3 \times 3 = 18 = \text{G. C. D.}$

(3)

$12 = 2 \times 2 \times 3$

$24 = 2 \times 2 \times 3 \times 2$

$60 = 2 \times 2 \times 3 \times 5$

2, 2 and 3 are common

$2 \times 2 \times 3 = 12 = \text{G. C. D.}$

(4)

$$15 = 3 \times 5$$

$$50 = 5 \times 5 \times 2$$

$$40 = 5 \times 2 \times 2 \times 2$$

5 is common.

$$5 = \text{G. C. D.}$$

(5)

$$24 = 2 \times 2 \times 2 \times 3$$

$$18 = 2 \times 3 \times 3$$

$$144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$$

2 and 3 are common.

$$2 \times 3 = 6 = \text{G. C. D.}$$

(6)

$$50 = 2 \times 5 \times 5$$

$$100 = 2 \times 2 \times 5 \times 5$$

$$80 = 2 \times 2 \times 2 \times 2 \times 5$$

2 and 5 are common.

$$2 \times 5 = 10 = \text{G. C. D.}$$

(7)

$$56 = 2 \times 2 \times 2 \times 7$$

$$84 = 2 \times 2 \times 3 \times 7$$

$$140 = 2 \times 2 \times 7 \times 5$$

2, 2 and 7 are common.

$$2 \times 2 \times 7 = 28 = \text{G. C. D.}$$

(1)

$$3328)4592(1$$

$$\underline{3328}$$

$$1264)3328(2$$

$$\underline{2528}$$

$$800)1264(1$$

$$\underline{800}$$

$$464)800(1$$

$$\underline{464}$$

$$336)464(1$$

$$\underline{336}$$

$$128)336(2$$

$$\underline{256}$$

$$80)128(1$$

$$\underline{80}$$

$$48)80(1$$

$$\underline{48}$$

$$32)48(1$$

$$\underline{32}$$

$$16)32(2$$

$$\underline{32}$$

$$16 = \text{G. C. D.}$$

(2)

$$2205)4501(2$$

$$\underline{4410}$$

$$91)2205(24$$

$$\underline{182}$$

$$385$$

$$\underline{364}$$

$$21)91(4$$

$$\underline{84}$$

$$7)21(3$$

$$\underline{21}$$

$$7 = \text{G. C. D.}$$

(8)

$$84 = 2 \times 2 \times 3 \times 7$$

$$154 = 2 \times 7 \times 11$$

$$210 = 2 \times 3 \times 5 \times 7$$

2 and 7 are common.

$$2 \times 7 = 14 = \text{G. C. D.}$$

(3)

$$\begin{array}{r}
 16082 \overline{)25740} (1 \\
 \underline{16082} \\
 9658 \overline{)16082} (1 \\
 \underline{9658}
 \end{array}$$

(4)

$$\begin{array}{r}
 620 \overline{)1116} (1 \\
 \underline{620} \\
 496 \overline{)620} (1 \\
 \underline{496} \\
 124 \overline{)496} (4 \\
 \underline{496} \\
 \dots
 \end{array}
 \qquad
 \begin{array}{r}
 6424 \overline{)9658} (1 \\
 \underline{6424} \\
 3234 \overline{)6424} (1 \\
 \underline{3234} \\
 3190 \overline{)3234} (1 \\
 \underline{3190} \\
 44 \overline{)3190} (72 \\
 \underline{308} \\
 110 \\
 88 \\
 22 \overline{)44} (2 \\
 \underline{44} \\
 \dots
 \end{array}$$

124 = G. C. D. = *Ans.*22 = G. C. D. = *Ans.*

(5)

$$\begin{array}{r}
 \overbrace{5270 \overline{)5952} (1} \qquad \overbrace{62 \overline{)5394} (87} \\
 \underline{5270} \qquad \underline{496} \\
 682 \overline{)5270} (7 \qquad 434 \\
 \underline{4774} \qquad \underline{434} \\
 496 \overline{)682} (1 \qquad \dots \\
 \underline{496} \\
 186 \overline{)496} (2 \\
 \underline{372} \\
 124 \overline{)186} (1 \\
 \underline{124} \\
 62 \overline{)124} (2 \\
 \underline{124} \\
 \dots
 \end{array}$$

$$\begin{array}{r}
 62 \overline{)3038} (49 \\
 \underline{248} \\
 558 \\
 \underline{558} \\
 \dots
 \end{array}$$

62 = G. C. D. = *Ans.*

$$\begin{array}{r}
 (6) \\
 4617 \overline{) 7695} (1 \\
 \underline{4617} \\
 3078 \\
 4617 (1 \\
 \underline{3078} \\
 1539 \\
 3078 (2 \\
 \underline{3078} \\
 \dots
 \end{array}
 \qquad
 \begin{array}{r}
 1539 \overline{) 6642} (4 \\
 \underline{6156} \\
 486 \\
 1539 (3 \\
 \underline{1458} \\
 81 \\
 486 (6 \\
 \underline{486} \\
 \dots
 \end{array}$$

$$\begin{array}{r}
 81 \overline{) 8424} (104 \\
 \underline{81} \\
 324 \\
 \underline{324} \\
 \dots
 \end{array}$$

$$81 = \text{G. C. D.} = \text{Ans.}$$

(7)

It is plain that the number of bushels in each load must be the greatest common divisor of 315 and 810. That divisor is 45. *Ans.*

(8)

The question is, what extent of ground is that which will be contained an exact number of times in the two tracts what is their greatest common divisor? *Ans.* 25 acres.

(9)

There are 1004 feet on one street, and 744 on the other. The panels belong to each front, and hence, the length of of each must be the greatest common divisor of the two sides : viz., 12 feet. *Ans.*

(10)

The greatest common divisor of the three numbers will be the number of bushels to be put into each bag. That divisor is 3. *Ans*

(11)

If each invests his whole money, the price of each cow must be a common divisor of the three amounts, \$286, \$462, and \$638: 2, 11, and 22 are common divisors, but only 22 will give the required number of cows, 63

$286 \div 22 = 13$, A bought; $462 \div 22 = 21$, B bought;
 $638 \div 22 = 29$, C bought. *Ans.*

COMMON FRACTIONS.

(2)

$$\frac{15}{16}, \frac{27}{16}, \frac{34}{16}.$$

(3)

$$\frac{27}{16}, \frac{25}{16}, \frac{106}{16}, \frac{27}{16}, \frac{41}{16}.$$

(4)

$$\frac{45}{88}, \frac{56}{88}, \frac{85}{88}, \frac{96}{88}, \frac{37}{88}.$$

(5)

$$\frac{9}{50}, \frac{27}{50}, \frac{75}{50}, \frac{88}{50}.$$

(1)

$$\frac{2}{3} \times 6 = \frac{12}{3}, \quad \frac{3}{5} \times 7 = \frac{21}{5}.$$

(2)

$$\frac{7}{8} \times 4 = \frac{28}{8}, \quad \frac{7}{8} \times 9 = \frac{63}{8}$$

(3)

$$\frac{5}{31} \times 11 = \frac{55}{31}, \quad \frac{5}{31} \times 12 = \frac{60}{31}.$$

(4)

$$\frac{7}{23} \times 12 = \frac{84}{23}, \quad \frac{7}{23} \times 14 = \frac{98}{23}.$$

(5)

$$\frac{47}{13} \times 3 = \frac{141}{13}, \quad \frac{47}{13} \times 4 = \frac{188}{13}.$$

(6)

$$\frac{14}{9} \times 7 = \frac{98}{9}, \quad \frac{14}{9} \times 9 = \frac{126}{9}.$$

(7)

$$\frac{47}{28} \times 5 = \frac{235}{28}, \quad \frac{47}{28} \times 10 = \frac{470}{28}.$$

(8)

$$\frac{27}{29} \times 3 = \frac{81}{29}, \quad \frac{27}{29} \times 11 = \frac{297}{29}.$$

(1)

$$\frac{17}{16} \times 8 = \frac{17}{16+8} = \frac{17}{2}, \quad \frac{17}{16} \times 4 = \frac{17}{16+4} = \frac{17}{4}, \quad \frac{17}{16} \times 2 = \frac{17}{16+2} = \frac{17}{8}.$$

(2)

$$\frac{2}{24} \times 2 = \frac{2}{12}, \quad \frac{2}{24} \times 3 = \frac{2}{8}, \quad \frac{2}{24} \times 4 = \frac{2}{6}, \quad \frac{2}{24} \times 6 = \frac{2}{4}, \quad \frac{2}{24} \times 8 = \frac{2}{3}.$$

(3)

$$\frac{7}{30} \times 6 = \frac{7}{5}, \quad \frac{7}{30} \times 5 = \frac{7}{6}, \quad \frac{7}{30} \times 10 = \frac{7}{3}, \quad \frac{7}{30} \times 15 = \frac{7}{2} \text{ Ans.}$$

(4)

$$\frac{17}{48} \times 2 = \frac{17}{24}, \quad \frac{17}{48} \times 3 = \frac{17}{16}, \quad \frac{17}{48} \times 4 = \frac{17}{12}, \quad \frac{17}{48} \times 6 = \frac{17}{8}, \\ \frac{17}{48} \times 8 = \frac{17}{6} \text{ Ans.}$$

(5)

$$\frac{6}{40} \times 4 = \frac{6}{10}, \quad \frac{6}{40} \times 5 = \frac{6}{8}, \quad \frac{6}{40} \times 10 = \frac{6}{4}, \quad \frac{6}{40} \times 20 = \frac{6}{2}.$$

(6)

$$\frac{7}{35} \times 7 = \frac{7}{5}, \quad \frac{7}{35} \times 5 = \frac{7}{7} \text{ Ans.}$$

(7)

$$\frac{6}{42} \times 21 = \frac{6}{2}, \quad \frac{6}{42} \times 6 = \frac{6}{7}, \quad \frac{6}{42} \times 7 = \frac{6}{6}, \quad \frac{6}{42} \times 3 = \frac{6}{14}, \quad \frac{6}{42} \times 2 = \frac{6}{21}.$$

(8)

$$\frac{12}{36} \times 3 = \frac{12}{12}, \quad \frac{12}{36} \times 4 = \frac{12}{9}, \quad \frac{12}{36} \times 6 = \frac{12}{6}, \quad \frac{12}{36} \times 9 = \frac{12}{4}, \\ \frac{12}{36} \times 12 = \frac{12}{3} \text{ Ans.}$$

(1)

$$\frac{16}{16} \div 2 = \frac{8}{8}, \quad \frac{16}{16} \div 4 = \frac{4}{4}, \quad \frac{16}{16} \div 8 = \frac{2}{8}, \quad \frac{16}{16} \div 16 = \frac{1}{16} \text{ Ans.}$$

(2)

$$\frac{14}{14} \div 2 = \frac{7}{7}, \quad \frac{14}{14} \div 7 = \frac{2}{7}, \quad \frac{14}{14} \div 14 = \frac{1}{14} \text{ Ans.}$$

(3)

$$\frac{20}{20} \div 2 = \frac{10}{10}, \quad \frac{20}{20} \div 5 = \frac{4}{5}, \quad \frac{20}{20} \div 4 = \frac{5}{5}, \quad \frac{20}{20} \div 10 = \frac{2}{10} \text{ Ans.}$$

(4)

$$\frac{60}{28} \div 5 = \frac{12}{28}, \quad \frac{60}{28} \div 6 = \frac{10}{28}, \quad \frac{60}{28} \div 10 = \frac{6}{28}, \quad \frac{60}{28} \div 15 = \frac{4}{28},$$

$$\frac{60}{28} \div 20 = \frac{3}{28}. \text{ Ans.}$$

(5)

$$\frac{18}{16} \div 2 = \frac{9}{16}, \quad \frac{18}{16} \div 3 = \frac{6}{16}, \quad \frac{18}{16} \div 6 = \frac{3}{16}, \quad \frac{18}{16} \div 9 = \frac{2}{16}. \text{ Ans.}$$

(6)

$$\frac{24}{25} \div 3 = \frac{8}{25}, \quad \frac{24}{25} \div 6 = \frac{4}{25}, \quad \frac{24}{25} \div 8 = \frac{3}{25}, \quad \frac{24}{25} \div 12 = \frac{2}{25}. \text{ Ans.}$$

(7)

$$\frac{27}{25} \div 3 = \frac{9}{25}, \quad \frac{27}{25} \div 9 = \frac{3}{25}, \quad \frac{27}{25} \div 27 = \frac{1}{25}. \text{ Ans.}$$

(8)

$$\frac{54}{25} \div 6 = \frac{9}{25}, \quad \frac{54}{25} \div 9 = \frac{6}{25}, \quad \frac{54}{25} \div 27 = \frac{2}{25}, \quad \frac{54}{25} \div 54 = \frac{1}{25}. \text{ Ans.}$$

(1)

$$\frac{2}{4} \div 6 = \frac{2}{4 \times 6} = \frac{2}{24}, \quad \frac{2}{4} \div 7 = \frac{2}{4 \times 7} = \frac{2}{28}, \quad \frac{2}{4} \div 8 = \frac{2}{4 \times 8} = \frac{2}{32}. \text{ Ans.}$$

(2)

$$\frac{4}{9} \div 5 = \frac{4}{45}, \quad \frac{4}{9} \div 4 = \frac{4}{36}, \quad \frac{4}{9} \div 9 = \frac{4}{81}. \text{ Ans.}$$

(3)

$$\frac{14}{21} \div 3 = \frac{14}{63}, \quad \frac{14}{21} \div 4 = \frac{14}{84}, \quad \frac{14}{21} \div 12 = \frac{14}{252}. \text{ Ans.}$$

(4)

$$\frac{20}{27} \div 6 = \frac{20}{27 \times 6}, \quad \frac{20}{27} \div 8 = \frac{20}{378}, \quad \frac{20}{27} \div 11 = \frac{20}{297}. \text{ Ans.}$$

(5)

$$\frac{15}{17} \div 7 = \frac{15}{119}, \quad \frac{15}{17} \div 5 = \frac{15}{85}, \quad \frac{15}{17} \div 3 = \frac{15}{51}. \text{ Ans.}$$

(6)

$$\frac{14}{27} \div 7 = \frac{14}{189}, \quad \frac{14}{27} \div 8 = \frac{14}{216}, \quad \frac{14}{27} \div 6 = \frac{14}{162}. \text{ Ans.}$$

(7)

$$\frac{25}{15} \div 3 = \frac{25}{45}, \quad \frac{25}{15} \div 7 = \frac{25}{105}, \quad \frac{25}{15} \div 11 = \frac{25}{165}. \text{ Ans.}$$

(8)

$$\frac{11}{8} \div 8 = \frac{11}{64}, \quad \frac{11}{8} \div 4 = \frac{11}{32}, \quad \frac{11}{8} \div 10 = \frac{11}{80}. \text{ Ans.}$$

(1)

$$\frac{7}{8} = \frac{7 \times 4}{8 \times 4} = \frac{28}{32}, \quad \frac{7 \times 7}{8 \times 6} = \frac{49}{48}, \quad \frac{7 \times 5}{8 \times 5} = \frac{35}{40}. \text{ Ans.}$$

(2)

$$\frac{8 \times 5}{11 \times 5} = \frac{40}{55}, \quad \frac{8 \times 8}{11 \times 8} = \frac{64}{88}, \quad \frac{8 \times 9}{11 \times 9} = \frac{72}{99}, \quad \frac{8 \times 11}{11 \times 11} = \frac{88}{121}.$$

(3)

$$\frac{16 \times 7}{19 \times 7} = \frac{112}{133}, \quad \frac{16 \times 8}{19 \times 8} = \frac{128}{152}, \quad \frac{16 \times 9}{19 \times 9} = \frac{144}{171}. \text{ Ans.}$$

(4)

$$\frac{14 \times 5}{29 \times 5} = \frac{70}{145}, \quad \frac{14 \times 8}{29 \times 8} = \frac{112}{232}, \quad \frac{14 \times 6}{29 \times 6} = \frac{84}{174}, \quad \frac{14 \times 12}{29 \times 12} = \frac{168}{348}.$$

(5)

$$\frac{23 \times 2}{25 \times 2} = \frac{46}{50}, \quad \frac{23 \times 3}{25 \times 3} = \frac{69}{75}, \quad \frac{23 \times 4}{25 \times 4} = \frac{92}{100}, \quad \frac{23 \times 5}{25 \times 5} = \frac{115}{125}.$$

(1)

$$\frac{4 \div 2}{8 \div 2} = \frac{2}{4}, \quad \frac{4 \div 4}{8 \div 4} = \frac{1}{2}.$$

(2)

$$\frac{3 \div 3}{6 \div 3} = \frac{1}{2}.$$

(3)

$$\frac{24 \div 2}{36 \div 2} = \frac{12}{18}, \quad \frac{24 \div 3}{36 \div 3} = \frac{8}{12}, \quad \frac{24 \div 4}{36 \div 4} = \frac{6}{9}, \quad \frac{24 \div 6}{36 \div 6} = \frac{4}{6}, \quad \frac{24 \div 12}{36 \div 12} = \frac{2}{3}.$$

(4)

$$\frac{48 \div 2}{64 \div 2} = \frac{24}{32}, \quad \frac{48 \div 4}{64 \div 4} = \frac{12}{16}, \quad \frac{48 \div 8}{64 \div 8} = \frac{6}{8}, \quad \frac{48 \div 16}{64 \div 16} = \frac{3}{4}.$$

(5)

$$\frac{72 \div 2}{96 \div 2} = \frac{36}{48}, \quad \frac{72 \div 3}{96 \div 3} = \frac{24}{32}, \quad \frac{72 \div 4}{96 \div 4} = \frac{18}{24}, \quad \frac{72 \div 6}{96 \div 6} = \frac{12}{16}, \quad \frac{72 \div 12}{96 \div 12} = \frac{6}{8}.$$

(6)

$$\frac{36 \div 2}{144 \div 2} = \frac{18}{72}, \quad \frac{36 \div 3}{144 \div 3} = \frac{12}{48}, \quad \frac{36 \div 4}{144 \div 4} = \frac{9}{36}, \quad \frac{36 \div 6}{144 \div 6} = \frac{6}{24}, \quad \frac{36 \div 36}{144 \div 36} = \frac{1}{4}.$$

REDUCTION OF FRACTIONS.

(1)

$$\frac{18 \times 7}{7} = \frac{126}{7}.$$

(2)

$$\frac{25 \times 12}{12} = \frac{300}{12}.$$

(3)

$$\frac{19 \times 8}{8} = \frac{152}{8}.$$

(4)

$$\frac{29 \times 14}{14} = \frac{406}{14}.$$

(5)

$$\frac{65 \times 37}{37} = \frac{2405}{37}.$$

(6)

$$\frac{145 \times 9}{9} = \frac{1305}{9}.$$

(7)

$$\frac{450 \times 12}{12} = \frac{5400}{12}.$$

(8)

$$\frac{327 \times 36}{36} = \frac{11772}{36}.$$

(9)

$$\frac{97 \times 128}{128} = \frac{12416}{128}.$$

(10)

$$\frac{167 \times 89}{89} = \frac{14863}{89}.$$

(11)

$$\frac{325 \times 75}{75} = \frac{24375}{75}.$$

(1)

$$\begin{array}{r} 397 \\ 8 \overline{) 319} \\ \underline{8} \\ 319 \\ \underline{8} \\ 8 \end{array}$$

(2)

$$\begin{array}{r} 1129 \\ 10 \overline{) 1129} \\ \underline{10} \\ 1129 \\ \underline{10} \\ 10 \end{array}$$

(3)

$$\begin{array}{r} 42711 \\ 24 \overline{) 10259} \\ \underline{48} \\ 24 \\ 10259 \\ \underline{10259} \\ 24 \end{array}$$

(4)

$$\begin{array}{r} 67637 \\ 51 \overline{) 34513} \\ \underline{51} \\ 34513 \\ \underline{34513} \\ 51 \end{array}$$

(5)

$$\begin{array}{r} 3679 \\ 104 \overline{) 38177} \\ \underline{104} \\ 38177 \\ \underline{38177} \\ 104 \end{array}$$

(6)

$$\begin{array}{r} 84736 \\ 175 \overline{) 148261} \\ \underline{175} \\ 148261 \\ \underline{148261} \\ 175 \end{array}$$

(7)

$$\begin{array}{r} 67426\cancel{368} = \cancel{59267822}. \\ 879 \\ \hline 59267822 \\ \hline 879 \end{array}$$

(8)

$$\begin{array}{r} 6751\cancel{87} = \cancel{135187}. \\ 200 \\ \hline 135187 \\ \hline 200 \end{array}$$

(9)

$$\begin{array}{r} 187\cancel{41} = \cancel{28278}. \\ 151 \\ \hline 28278 \\ \hline 151 \end{array}$$

(10)

$$\begin{array}{r} 149\cancel{5} = \cancel{1346}. \\ 9 \\ \hline 1346 \\ \hline 9 \end{array}$$

(11)

$$\begin{array}{r} 375\cancel{84} = \cancel{37219}. \\ 99 \\ \hline 37219 \\ \hline 99 \end{array}$$

(12)

$$\begin{array}{r} 17494\cancel{543} = \cancel{1749383049}. \\ 99999 \\ \hline 1749383049 \\ \hline 99999 \end{array}$$

(13)

$$\begin{array}{r} 4834\cancel{57} = \cancel{459287}. \\ 95 \\ \hline 459287 \\ \hline 95 \end{array}$$

(14)

$$\begin{array}{r} 1789\cancel{5} = \cancel{16106}. \\ 9 \\ \hline 16106 \\ \hline 9 \end{array}$$

(15)

$$\begin{array}{r} 125\cancel{6} = \cancel{881}. \\ 7 \\ \hline 881 \\ \hline 7 \end{array}$$

(16)

$$\begin{array}{r} 375\cancel{3} = \cancel{1503}. \\ 4 \\ \hline 1503 \\ \hline 4 \end{array}$$

(17)

$$\begin{array}{r} 4641\cancel{8} = \cancel{29251}. \\ 63 \\ \hline 29251 \\ \hline 63 \end{array}$$

(18)

$$\begin{array}{r} 961\cancel{1} = \cancel{61451}. \\ 640 \\ \hline 61451 \\ \hline 640 \end{array}$$

(19)

$$\begin{array}{r} 984\cancel{41} = \cancel{110249}. \\ 112 \\ \hline 110249 \\ \hline 112 \end{array}$$

$$\begin{array}{rcl}
 (20) & (21) & (22) \quad (23) \\
 35\frac{72}{366} = 12\frac{82}{366} & 87\frac{41}{135} = 11\frac{76}{135} & 77\frac{7}{7} = 78 & 333\frac{3}{3} = 334 \\
 \underline{366} & \underline{135} & & \\
 12882 & 11786 & & \\
 \underline{366} & \underline{135} & &
 \end{array}$$

$$\begin{array}{rcl}
 (1) \\
 108 \\
 63 \overline{)108} = 1\frac{4}{3} \\
 \underline{63} \\
 14\frac{4}{3}
 \end{array}$$

$$\begin{array}{rcl}
 (2) \\
 576 \\
 48 \overline{)576} = 12 \\
 \underline{48} \\
 12
 \end{array}$$

$$\begin{array}{rcl}
 (3) \\
 1764 \\
 324 \overline{)1764} = 5\frac{11}{11} \\
 \underline{1620} \\
 51\frac{11}{11}
 \end{array}$$

$$\begin{array}{rcl}
 (4) \\
 19900 \\
 800 \overline{)19900} = 24\frac{700}{800} \\
 \underline{19200} \\
 24\frac{700}{800}
 \end{array}$$

$$\begin{array}{rcl}
 (5) \\
 135 \\
 15 \overline{)135} = 9 \\
 \underline{135} \\
 9
 \end{array}$$

$$\begin{array}{rcl}
 (6) \\
 2358 \\
 42 \overline{)2358} = 56\frac{6}{42} \\
 \underline{2520} \\
 56\frac{6}{42}
 \end{array}$$

$$\begin{array}{rcl}
 (7) \\
 6284 \\
 56 \overline{)6284} = 112\frac{12}{56} \\
 \underline{6272} \\
 112\frac{12}{56}
 \end{array}$$

$$\begin{array}{rcl}
 (8) \\
 4976 \\
 224 \overline{)4976} = 22\frac{48}{224} \\
 \underline{4928} \\
 22\frac{48}{224}
 \end{array}$$

$$\begin{array}{rcl}
 (9) \\
 102409 \\
 160 \overline{)102409} = 640\frac{9}{160} \\
 \underline{102400} \\
 640\frac{9}{160}
 \end{array}$$

$$\begin{array}{rcl}
 (10) \\
 4478 \\
 841 \overline{)4478} = 5\frac{273}{841} \\
 \underline{4205} \\
 5\frac{273}{841}
 \end{array}$$

$$\begin{array}{rcl}
 (11) \\
 17959 \\
 1256 \overline{)17959} = 14\frac{375}{1256} \\
 \underline{17584} \\
 14\frac{375}{1256}
 \end{array}$$

$$\begin{array}{rcl}
 (12) \\
 526950 \\
 2342 \overline{)526950} = 225 \\
 \underline{526950} \\
 225
 \end{array}$$

$$\begin{array}{r} (13) \\ 4790 \\ 25 \overline{) 4790} = 191 \frac{15}{25} \\ 191 \frac{15}{25} \end{array}$$

$$\begin{array}{r} (14) \\ 1512 \\ 108 \overline{) 1512} = 14 \\ 14 \end{array}$$

$$\begin{array}{r} (15) \\ 375941 \\ 999 \overline{) 375941} = 376 \frac{317}{999} \\ 376 \frac{317}{999} \end{array}$$

$$\begin{array}{r} (16) \\ 3745174 \\ 349 \overline{) 3745174} = 10731 \frac{55}{349} \\ 10731 \frac{55}{349} \end{array}$$

$$\begin{array}{r} (1) \\ 7 \div 7 = 1 \text{ Ans.} \\ 49 \div 7 = 7 \end{array}$$

$$\begin{array}{r} (2) \\ 84 \div 12 = 7 \div 7 \\ 420 \div 12 = 35 \div 7 = 5 \text{ Ans.} \end{array}$$

$$\begin{array}{r} (3) \\ 104 \div 8 = 13 \div 13 \\ 312 \div 8 = 39 \div 13 = 3 \text{ Ans.} \end{array}$$

$$\begin{array}{r} (4) \\ 1049 \div 1049 \\ 8392 \div 1049 = 8 \text{ Ans.} \end{array}$$

$$\begin{array}{r} (5) \\ 275 \div 5 = 55 \div 11 = 5 \text{ Ans.} \\ 440 \div 5 = 88 \div 11 = 8 \end{array}$$

$$\begin{array}{r} (6) \\ 351 \div 3 = 117 \text{ Ans.} \\ 795 \div 3 = 265 \end{array}$$

$$\begin{array}{r} (7) \\ 172 \div 2 = 86 \div 43 \\ 1118 \div 2 = 559 \div 43 = 13 \text{ Ans.} \end{array}$$

(8)
The greatest common divisor of 63 and 81 is 9.

$$\begin{array}{r} 63 \div 9 \\ 81 \div 9 = 9 \text{ Ans.} \end{array}$$

(9)
The greatest common divisor of 315 and 405 is 45.

$$\begin{array}{r} 315 \div 45 \\ 405 \div 45 = 9 \text{ Ans.} \end{array}$$

(10)

The greatest common divisor of 1157 and 623 is 89

$$\frac{1157}{623} \div 89 = \frac{13}{7} = 1\frac{6}{7} \text{ Ans.}$$

(11)

The greatest common divisor of 792 and 1386 is 198.

$$\frac{792}{1386} \div 198 = \frac{4}{7} \text{ Ans.}$$

(12)

G. C. D. = 2.

$$\frac{374}{1030} \div 2 = \frac{187}{515}$$

(13)

G. C. D. = 10.

$$\frac{410}{510} \div 10 = \frac{41}{51} \text{ Ans.}$$

(14)

G. C. D. = 5.

$$\frac{345}{1745} \div 5 = \frac{69}{349} \text{ Ans.}$$

(15)

G. C. D. = 27.

$$\frac{8343}{9747} \div 27 = \frac{309}{361} \text{ Ans.}$$

(16)

G. C. D. = 3.

$$\frac{549}{7143} \div 3 = \frac{183}{2381} \text{ Ans.}$$

(17)

G. C. D. = 180.

$$\frac{2160}{2340} \div 180 = \frac{12}{13} \text{ Ans.}$$

(18)

G. C. D. = 63.

$$\frac{315}{1512} \div 63 = \frac{5}{24} \text{ Ans.}$$

(19)

G. C. D. = 960.

$$\frac{10560}{35520} \div 960 = \frac{11}{33} \text{ Ans.}$$

(20)

G. C. D. = 288.

$$\frac{6048}{38592} \div 288 = \frac{21}{134}$$

(21)

G. C. D. = 864.

$$\frac{864}{21600} \div 864 = \frac{1}{25}$$

(22)

G. C. D. = 540.

$$\frac{1080}{66420} \div 540 = \frac{2}{113}$$

WITHOUT CANCELLATION.

(1)

$$\frac{3}{4} \text{ of } \frac{5}{6} \text{ of } \frac{2}{3} = \frac{3 \times 5 \times 2}{4 \times 6 \times 3} = \frac{30}{72} = \frac{5}{12} \text{ Ans.}$$

(2)

$$\frac{2}{5} \text{ of } \frac{7}{9} \text{ of } \frac{3}{4} = \frac{2 \times 7 \times 3}{5 \times 9 \times 4} = \frac{42}{180} = \frac{7}{30} \text{ Ans.}$$

BY CANCELLATION.

(3)

$$\frac{2}{3} \text{ of } \frac{3}{7} \text{ of } \frac{9}{\frac{1}{2}} = \frac{2}{14} \text{ Ans.}$$

(4)

$$\frac{2}{9} \text{ of } \frac{3}{5} \text{ of } \frac{5}{\frac{1}{2}} \text{ of } \frac{10}{3} = \frac{5}{18} \text{ Ans.}$$

(5)

$$\frac{3}{\frac{9}{2}} \text{ of } \frac{2}{3} \text{ of } \frac{7}{8} \text{ of } \frac{5}{\frac{1}{2}} = \frac{3}{18}$$

(6)

$$\frac{1}{4} \text{ of } \frac{1}{2} \text{ of } \frac{3}{4} \text{ of } \frac{25}{2} = \frac{75}{64} = 1\frac{11}{64}$$

(7)

$$\frac{2}{7} \text{ of } \frac{5}{6} \text{ of } \frac{\frac{1}{7}}{\frac{21}{5}} = 1 \text{ Ans.}$$

(8)

$$\frac{3}{20} \text{ of } \frac{11}{3} \text{ of } \frac{13}{\frac{65}{12}} = \frac{143}{4} = 35\frac{3}{4}$$

(9)

$$\frac{7}{8} \text{ of } \frac{28}{3} \text{ of } \frac{45}{7} \text{ of } \frac{14}{5} = \frac{147}{1} = 147 \text{ Ans.}$$

(10)

$$\frac{9}{14} \text{ of } \frac{7}{12} \text{ of } \frac{49}{9} = \frac{49}{6} = 8\frac{1}{6} \text{ Ans.}$$

(11)

$$\frac{3}{4} \text{ of } \frac{5}{6} \text{ of } \frac{5}{9} \text{ of } \frac{27}{100} \text{ of } \frac{5}{13} = \frac{15}{118} \text{ Ans.}$$

(12)

$$\frac{41}{110} \text{ of } \frac{3}{14} \text{ of } \frac{57}{108} \text{ of } \frac{3}{7} = \frac{41}{3080} \text{ Ans.}$$

(13)

$$\frac{29}{8} \text{ of } \frac{5}{7} \text{ of } \frac{32}{301} \text{ of } \frac{7}{1} = \frac{580}{43} = 13\frac{1}{43} \text{ Ans.}$$

(1)

$$\frac{3}{4}, 5\frac{1}{2} = \frac{16}{84}, \frac{6}{7} = \frac{63}{84}, \frac{448}{84}, \frac{72}{84} \text{ Ans.}$$

$$3 \times 3 \times 7 = 63 \text{ 1st numerator.}$$

$$16 \times 4 \times 7 = 448 \text{ 2d "}$$

$$6 \times 4 \times 3 = 72 \text{ 3d "}$$

$$4 \times 3 \times 7 = 84 \text{ com. denom.}$$

(2)

$$\frac{2}{3}, \frac{2}{5}, \frac{1}{7}, \frac{5}{2} = \frac{126}{210}, \frac{140}{210}, \frac{30}{210}, \frac{525}{210} \text{ Ans.}$$

$$3 \times 3 \times 7 \times 2 = 126 \text{ 1st numerator.}$$

$$2 \times 5 \times 7 \times 2 = 140 \text{ 2d "}$$

$$1 \times 5 \times 3 \times 2 = 30 \text{ 3d "}$$

$$5 \times 5 \times 3 \times 7 = 525 \text{ 4th "}$$

$$5 \times 3 \times 7 \times 2 = 210 \text{ com. denom.}$$

(3)

$$\frac{19}{2}, \frac{13}{3}, \frac{11}{4}, \frac{4}{5} = \frac{1140}{120}, \frac{520}{120}, \frac{330}{120}, \frac{96}{120} \text{ Ans.}$$

$$19 \times 3 \times 4 \times 5 = 1140 \text{ 1st numerator.}$$

$$13 \times 2 \times 4 \times 5 = 520 \text{ 2d "}$$

$$11 \times 2 \times 3 \times 5 = 330 \text{ 3d "}$$

$$4 \times 2 \times 3 \times 4 = 96 \text{ 4th "}$$

$$2 \times 3 \times 4 \times 5 = 120 \text{ com. denom.}$$

(4)

$$\frac{2}{3} = \frac{2 \times 8}{3 \times 8} = \frac{16}{24}, \quad \frac{7}{8} = \frac{7 \times 3}{8 \times 3} = \frac{21}{24},$$

$$\frac{5}{6} = \frac{5 \times 4}{6 \times 4} = \frac{20}{24}, \quad \frac{1}{2} = \frac{1 \times 12}{2 \times 12} = \frac{12}{24}, \quad \frac{9}{4} = \frac{9 \times 6}{4 \times 6} = \frac{54}{24}.$$

(5)

$$2\frac{1}{2} \text{ of } 3 = \frac{5}{2} \text{ of } 3 = \frac{15}{2}$$

$$\frac{15}{2}, \frac{6}{7}, \frac{4}{9}, \frac{3}{5} = \frac{4725}{630}, \frac{540}{630}, \frac{280}{630}, \frac{378}{630}.$$

$$15 \times 7 \times 9 \times 5 = 4725 \text{ 1st numerator.}$$

$$6 \times 2 \times 9 \times 5 = 540 \text{ 2d "}$$

$$4 \times 2 \times 7 \times 5 = 280 \text{ 3d "}$$

$$3 \times 2 \times 7 \times 9 = 378 \text{ 4th "}$$

$$2 \times 7 \times 9 \times 5 = 630 \text{ com. donom}$$

(6)

$$2\frac{1}{2} \text{ of } 3\frac{1}{4} = \frac{5}{2} \text{ of } 2\frac{3}{4} = 11\frac{9}{4}$$

$$11\frac{9}{4}, 4^2 = 990, 588$$

$$110 \times 9 = 990 \text{ 1st numerator.}$$

$$42 \times 14 = 588 \text{ 2d "}$$

$$14 \times 9 = 126 \text{ com. denom.}$$

(7)

$$\frac{6}{21}, \frac{24}{5} = \frac{30}{105}, 714.$$

$$6 \times 5 = 30 \text{ 1st numerator.}$$

$$34 \times 21 = 714 \text{ 2d "}$$

$$21 \times 5 = 105 \text{ com. denom.}$$

(8)

$$4\frac{1}{2}, \frac{7}{2}, \frac{1}{2}, \frac{6}{1} = \frac{22}{14}, \frac{42}{14}, \frac{22}{14}, \frac{102}{14}$$

(9)

$$2\frac{6}{8}, \frac{6}{8}, \frac{7}{8}, \frac{1}{3} = \frac{156}{30}, \frac{36}{30}, \frac{105}{30}, \frac{110}{30}$$

(10)

$$\frac{3}{4} \text{ of } 5\frac{1}{3} = \frac{3}{4} \text{ of } \frac{16}{3} = 4$$

$$4, 2\frac{4}{5} = \frac{20}{5}, \frac{24}{5}.$$

(11)

$$4\frac{1}{2} \text{ of } 3\frac{1}{2} = \frac{13}{2} \text{ of } \frac{7}{2} = 9\frac{1}{2}$$

$$9\frac{1}{2}, \frac{54}{7} = \frac{637}{42}, \frac{324}{42}$$

$$91 \times 7 = 637 \text{ 1st numerator.}$$

$$54 \times 6 = 324 \text{ 2d "}$$

$$6 \times 7 = 42 \text{ com. denom.}$$

(12)

$$2\frac{6}{7}, \frac{3}{7}, 4\frac{3}{7}, \frac{1}{3} = \frac{266}{21}, \frac{9}{21}, \frac{129}{21}, \frac{7}{21}.$$

(1)

$$\frac{3}{4} \times 3 = \frac{9}{12}; \frac{7}{12}; \frac{1}{2} \times 6 = \frac{6}{12}; \frac{5}{6} \times 2 = \frac{10}{12}.$$

(2)

$$\frac{6}{7} \times 3 = \frac{18}{21}; \frac{8}{21}; \frac{2}{3} \times 7 = \frac{14}{21}.$$

(3)

$$\frac{21}{5} \times 4 = \frac{84}{5}; \quad \frac{9}{10} \times 2 = \frac{18}{5}; \quad \frac{29}{4} \times 5 = \frac{145}{4}.$$

(4)

$$\frac{95}{9} \times 2 = \frac{190}{9}; \quad \frac{5}{6} \times 3 = \frac{15}{6}; \quad \frac{22}{3} \times 6 = \frac{132}{3}.$$

(5)

$$\frac{31}{5} \times 6 = \frac{186}{5}; \quad \frac{5}{6} \times 5 = \frac{25}{6}; \quad \frac{22}{3} \times 10 = \frac{220}{3}.$$

(6)

$$\frac{4}{5} \times 8 = \frac{32}{5}; \quad \frac{7}{8} \times 5 = \frac{35}{8}; \quad \frac{29}{2} \times 20 = \frac{580}{2}; \quad \frac{15}{4} \times 10 = \frac{150}{4}.$$

(7)

$$\frac{7}{12} \times 6 = \frac{42}{12}; \quad \frac{8}{9} \times 8 = \frac{64}{9}; \quad \frac{17}{6} \times 12 = \frac{204}{6}; \quad \frac{11}{8} \times 9 = \frac{99}{8}.$$

(8)

$$\frac{6}{7} \times 6 = \frac{36}{7}; \quad \frac{1}{6} \times 7 = \frac{7}{6}; \quad \frac{16}{21} \times 2 = \frac{32}{21}; \quad \frac{2}{3} \times 14 = \frac{28}{3}.$$

(9)

$$\frac{9}{11} \times 4 = \frac{36}{11}; \quad \frac{3}{4} \times 11 = \frac{33}{4}; \quad \frac{19}{22} \times 2 = \frac{38}{22}; \quad \frac{1}{2} \times 22 = \frac{22}{2}.$$

(10)

$$\frac{5}{2} \times 30 = \frac{150}{2}; \quad \frac{31}{6} \times 10 = \frac{310}{6}; \quad \frac{9}{10} \times 6 = \frac{54}{10}; \quad \frac{53}{12} \times 5 = \frac{265}{12}.$$

(1)

$$\frac{3}{8}, \frac{4}{7}, \frac{5}{12} = \frac{63}{168}, \frac{96}{168}, \frac{70}{168}.$$

168 = least com. mul. or denom.

$$168 \div 8 = 21; 21 \times 3 = 63 = \text{1st numerator.}$$

$$168 \div 7 = 24; 24 \times 4 = 96 = 2d \quad "$$

$$168 \div 12 = 14; 14 \times 5 = 70 = 3d \quad "$$

(2)

$$\frac{5}{14}, \frac{3}{7}, \frac{16}{21} = \frac{15}{42}, \frac{18}{42}, \frac{32}{42}.$$

42 = least com. denom.

$$42 \div 14 = 3; 3 \times 5 = 15 = \text{1st numerator.}$$

$$42 \div 7 = 6; 6 \times 3 = 18 = 2d \quad "$$

$$42 \div 21 = 2; 2 \times 16 = 32 = 3d \quad "$$

(3)

$$2\frac{3}{4} = \frac{11}{4}, \frac{5}{16}, \frac{9}{32} = \frac{88}{32}, \frac{10}{32}, \frac{9}{32}$$

32 = least com. denom.

$$32 \div 4 = 8; 8 \times 11 = 88 \text{ 1st numerator.}$$

$$32 \div 16 = 2; 2 \times 5 = 10 \text{ 2d} \quad "$$

$$32 \div 32 = 1; 1 \times 9 = 9 \text{ 3d} \quad "$$

(4)

$$5\frac{3}{4} = \frac{43}{4}, 4\frac{5}{12} = \frac{53}{12}, \frac{7}{24} = \frac{129}{24}, \frac{106}{24}, \frac{7}{24}$$

24 = least com. denom.

$$24 \div 4 = 6; 6 \times 43 = 258 = \text{1st numerator.}$$

$$24 \div 12 = 2; 2 \times 53 = 106 = 2d \quad "$$

$$24 \div 24 = 1; 1 \times 7 = 7 = 3d \quad "$$

(5)

$$8\frac{7}{15} = \frac{127}{15}, \frac{2}{3}, \frac{7}{30} = \frac{254}{30}, \frac{12}{30}, \frac{7}{30}$$

30 = least com. denom.

$$30 \div 15 = 2; 2 \times 127 = 254 = \text{1st numerator.}$$

$$30 \div 5 = 6; 6 \times 2 = 12 = 2d \quad "$$

$$30 \div 30 = 1; 1 \times 7 = 7 = 3d \quad "$$

n*

(6)

$$9\frac{8}{11} = \frac{107}{11}, \frac{3}{22}, \frac{5}{33} = \frac{642}{66}, \frac{9}{66}, \frac{10}{66}$$

66 = least com. denom.

$$66 \div 11 = 6; \quad 6 \times 107 = 642 = \text{1st numerator.}$$

$$66 \div 22 = 3; \quad 3 \times 3 = 9 = 2d \quad "$$

$$66 \div 33 = 2; \quad 2 \times 5 = 10 = 3d \quad "$$

(7)

$$2\frac{1}{2} = \frac{5}{2}, \quad 3\frac{5}{2} = \frac{68}{2} = \frac{1}{14}, \frac{105}{42}, \frac{136}{42}, \frac{3}{42}$$

42 = least com. denom..

$$42 \div 2 = 21; \quad 21 \times 5 = 105 = \text{1st numerator}$$

$$42 \div 21 = 2; \quad 2 \times 68 = 136 = 2d \quad "$$

$$42 \div 14 = 3; \quad 3 \times 1 = 3 = 3d \quad "$$

(8)

$$3\frac{5}{12} = \frac{41}{12}, \frac{7}{6}, \frac{3}{8}, \frac{9}{16} = \frac{164}{48}, \frac{56}{48}, \frac{18}{48}, \frac{27}{48}$$

48 = least com. denom.

$$48 \div 12 = 4; \quad 4 \times 41 = 164 = \text{1st numerator.}$$

$$48 \div 6 = 8; \quad 8 \times 7 = 56 = 2d \quad "$$

$$48 \div 8 = 6; \quad 6 \times 3 = 18 = 3d \quad "$$

$$48 \div 16 = 3; \quad 3 \times 9 = 27 = 4th \quad "$$

(9)

$$\frac{8}{9}, \frac{5}{27}, \frac{7}{36} = \frac{96}{108}, \frac{20}{108}, \frac{21}{108}$$

108 = least com. denom.

$$108 \div 9 = 12; \quad 12 \times 8 = 96 = \text{1st numerator.}$$

$$108 \div 27 = 4; \quad 4 \times 5 = 20 = 2d \quad "$$

$$108 \div 36 = 3; \quad 3 \times 7 = 21 = 3d \quad "$$

(10)

$$4\frac{6}{13} = \frac{58}{13}, \quad 7\frac{3}{26} = \frac{185}{26}, \frac{5}{39} = \frac{348}{78}, \frac{555}{78}, \frac{10}{78}$$

78 = least com. denom.

$$78 \div 13 = 6; \quad 6 \times 58 = 348 = \text{1st numerator.}$$

$$78 \div 26 = 3; \quad 3 \times 185 = 555 = 2d \quad "$$

$$78 \div 39 = 2; \quad 2 \times 5 = 10 = 3d \quad "$$

(11)

$$6\frac{1}{2} = \frac{3^2}{2}, 8\frac{7}{10} = \frac{87}{10}, 2\frac{9}{20} = \frac{49}{10} = \frac{12^9}{20}, \frac{17^4}{20}, \frac{48}{10}$$

20 = least com. denom.

$$20 \div 5 = 4; 4 \times 32 = 128 = \text{1st numerator.}$$

$$20 \div 10 = 2; 2 \times 87 = 174 = 2d \quad "$$

$$20 \div 20 = 1; 1 \times 49 = 49 = 3d \quad "$$

(12)

$$\frac{9}{17}, 2\frac{3}{34} = \frac{71}{34}, 1\frac{5}{68} = \frac{73}{68} = \frac{36}{68}, \frac{142}{68}, \frac{63}{34}$$

68 = least com. denom.

$$68 \div 17 = 4; 4 \times 9 = 36 = \text{1st numerator.}$$

$$68 \div 34 = 2; 2 \times 71 = 142 = 2d \quad "$$

$$68 \div 68 = 1; 1 \times 73 = 73 = 3d \quad "$$

(13)

$$5\frac{7}{9} = \frac{52}{9}, 6\frac{5}{18} = \frac{113}{18}, \frac{7}{36}, \frac{1}{72} = \frac{11^6}{72}, \frac{45^2}{72}, \frac{14}{72}, \frac{1}{72}$$

72 = least com. denom.

$$72 \div 9 = 8; 8 \times 52 = 416 = \text{1st numerator.}$$

$$72 \div 18 = 4; 4 \times 113 = 452 = 2d \quad "$$

$$72 \div 36 = 2; 2 \times 7 = 14 = 3d \quad "$$

$$72 \div 72 = 1; 1 \times 1 = 1 = 4th \quad "$$

DENOMINATE FRACTIONS.

(1)

$$\frac{23}{4} = \frac{3}{4} \times \frac{20}{1} \times \frac{12}{1} \times \frac{4}{1} = 7\frac{1}{2} \text{ far.}$$

(2)

$$\frac{5}{6} \text{ ton} = \frac{5}{6} \times \frac{10}{1} \times \frac{20}{1} \times \frac{4}{1} \times \frac{25}{1} = \frac{5000}{8} = 1666\frac{1}{2} \text{ lb.}$$

(3)

$$\frac{7}{9} \text{ wk.} = \frac{7}{9} \times \frac{7}{1} \times \frac{24}{1} \times \frac{20}{60} = 7840 \text{ min.}$$

(4)

$$\frac{9}{16} \text{ lb.} = \frac{9}{16} \times \frac{3}{12} \times \frac{5}{20} \times \frac{24}{1} = 3240 \text{ gr.}$$

(5)

$$\frac{2}{8} \text{ in.} = \frac{2}{8} \times \frac{1}{12} \times \frac{1}{3} \times \frac{1}{5\frac{1}{2}} = \frac{1}{72} \text{ rd.}$$

(6)

$$\frac{4}{5} \text{ in.} = \frac{4}{5} \times \frac{1}{12} \times \frac{1}{3} = \frac{1}{45} \text{ yd.}$$

(7)

$$\frac{11}{20} \text{ sec.} = \frac{11}{20} \times \frac{1}{60} \times \frac{1}{60} = \frac{11}{7200} \text{ deg}$$

(8)

$$\frac{15}{26} \text{ cu. ft.} = \frac{15}{26} \times \frac{1}{128} = \frac{15}{3328} \text{ C}$$

(9)

$$\mathcal{L}_{16}^7 = 8\text{s. } 9\text{d.}$$

$$\begin{array}{r} 7 \\ 20 \\ 16 \overline{)140} \\ \text{s. } 8 \quad \dots 12 \\ \quad 12 \\ 16 \overline{)144} \\ \text{d. } 9 \end{array}$$

$$\mathcal{L}_{15}^7 = 9\text{s. } 4\text{d.}$$

$$\begin{array}{r} 7 \\ 20 \\ 15 \overline{)140} \\ \text{s. } 9 \quad \dots 5 \\ \quad 12 \\ 15 \overline{)60} \\ \text{d. } 4 \end{array}$$

(10)

$$\frac{7}{8} \text{ mi.} = 6 \text{ fur. } 8 \text{ rd. } 4 \text{ yd. } 2 \text{ ft. } 8 \text{ in.}$$

$\begin{array}{r} 7 \\ 8 \\ 9 \overline{)56} \\ \text{fur. } 6 \dots 2 \\ 40 \\ 9 \overline{)86} \\ \text{rd. } 8 \dots 8 \\ 5\frac{1}{2} \\ 9 \overline{)44} \\ \text{yd. } 4 \dots 8 \\ 3 \\ 9 \overline{)24} \\ \text{ft. } 2 \dots 6 \\ 12 \\ 9 \overline{)72} \\ \text{in. } 8 \end{array}$	$\begin{array}{r} \frac{8}{7} \text{ mi.} = 6 \text{ fur. } 34 \text{ rd. } 1 \text{ yd. } 1 \text{ ft. } 8\frac{1}{4} \text{ in.} \\ 6 \\ 8 \\ 7 \overline{)48} \\ \text{fur. } 6 \dots 6 \\ 40 \\ 7 \overline{)240} \\ \text{rd. } 34 \dots 2 \\ 5\frac{1}{2} \\ 7 \overline{)11} \\ \text{yd. } 1 \dots 4 \\ 3 \\ 7 \overline{)12} \\ \text{ft. } 1 \dots 5 \\ 12 \\ 7 \overline{)60} \\ \text{in. } 8\frac{1}{4} \end{array}$
--	---

(11)

$$\frac{5}{6} \text{ fur.} = 33 \text{ rd. } 1 \text{ yd. } 2 \text{ ft. } 6 \text{ in.}$$

$$\begin{array}{r} 5 \\ 40 \\ 6 \overline{)200} \\ \text{rd. } 33 \dots 2 \\ 5\frac{1}{2} \\ 6 \overline{)11} \\ \text{yd. } 1 \dots 5 \\ 3 \\ 6 \overline{)15} \\ \text{ft. } 2 \dots 3 \\ 12 \\ 6 \overline{)36} \\ \text{in. } 6 \end{array}$$

(12)

$$\frac{3}{4} \text{ guin.} = \frac{3}{4} \times \frac{1}{12} \times \frac{1}{21} = \frac{1}{28} \text{ guin.}$$

(13)

$$\frac{7}{9} \text{ far.} = \frac{7}{9} \times \frac{1}{4} \times \frac{1}{12} \times \frac{1}{21} \times \frac{1}{6} = \frac{1}{72} \text{ far.}$$

(14)

$$\frac{9}{11} \text{ hr.} = \frac{9}{11} \times \frac{60}{1} \times \frac{1}{1} \times \frac{1}{5} = \frac{648}{11} \text{ min.}$$

(1)

7 fur 28 rd. 2 yd. = 1696 yd.

1 mile = 1760 "

$$\frac{1696}{1760} = \frac{53}{55} \text{ miles. } Ans.$$

(2)

17s. 6d. 2 far. = 842 far.

£1 = 960 "

$$\frac{842}{960} = \frac{421}{480} \text{ Ans.}$$

(3)

19 cwt. 3 qr. 16 lb. = 1991 lb.

1 ton = 2000 "

$$\frac{1991}{2000} \text{ ton. } Ans.$$

(4)

9 oz. 5½ pwt. = 927 5thspwt

1 lb. = 1200 "

$$\frac{927}{1200} = \frac{309}{400} \text{ lb. } Ans.$$

(5)

5 da. 16 hr. 40 min. = 8200 min.

1 wk. = 10080 "

$$\frac{8200}{10080} = \frac{205}{252} \text{ Ans.}$$

(6)

3 pk. 7 qt. 1 pt. = 63 pt.

1 bu. = 64 "

$$\frac{63}{64} \text{ bu. } Ans.$$

(7)

3 qr. 3 na. 1 in. = 127 fourths of 1 inch.

1 yd. = 144 " "

$$\frac{127}{144} \text{ yd. } Ans.$$

(8)

18s. 8d. 3 far. = 899 far.

£1 9s. 6d. = 1416 "

$$\frac{899}{1416} \text{ Ans.}$$

(9)

⅞ s. = 10d. 2 far. = 42 far.

£⅞ = 12s. = 576 "

$$\frac{42}{576} = \frac{7}{96} \text{ Ans.}$$

(10)

4⅞ d. = 43 ninths of a penny.

£⅞ = 9s 10⅞d. = 960 " "

$$\frac{43}{960} \text{ Ans.}$$

ADDITION.

(2)

$$\frac{1}{2} + \frac{1}{3} = \frac{3}{6} + \frac{2}{6} = \frac{5}{6}; \quad \frac{1}{3} + \frac{1}{5} = \frac{5}{15} + \frac{2}{15} = \frac{7}{15}; \quad \frac{1}{4} + \frac{1}{6} = \frac{3}{12} + \frac{2}{12} = \frac{5}{12};$$

$$\frac{1}{5} + \frac{1}{10} = \frac{2}{10} + \frac{1}{10} = \frac{3}{10} \text{ Ans.}$$

(3)

$$\frac{1}{2} + \frac{1}{10} = \frac{5}{10} + \frac{1}{10} = \frac{6}{10}; \quad \frac{1}{3} + \frac{1}{6} = \frac{2}{6} + \frac{1}{6} = \frac{3}{6};$$

$$\frac{1}{8} + \frac{1}{8} = \frac{2}{8} + \frac{2}{8} = \frac{4}{8}; \quad \frac{1}{8} + \frac{1}{8} = \frac{2}{8} + \frac{2}{8} = \frac{4}{8} \text{ Ans.}$$

(1)

$$\frac{5}{8} + \frac{7}{12} + \frac{5}{18} + \frac{7}{24} = \frac{35}{612} + \frac{357}{612} + \frac{175}{612} + \frac{175}{612} = \frac{1623}{612} = 2\frac{33}{102}$$

612 = least com. denom.

$$612 \div 9 = 68; 68 \times 5 = 340 \text{ 1st numerator.}$$

$$612 \div 12 = 51; 51 \times 7 = 357 \text{ 2d } "$$

$$612 \div 18 = 34; 34 \times 5 = 170 \text{ 3d } "$$

$$612 \div 17 = 36; 36 \times 21 = 756 \text{ 4th } "$$

$$\frac{1623}{612} = \text{sum.}$$

$$612 \overline{)1623}$$

$$2\frac{33}{102} = 2\frac{11}{34} \text{ Ans.}$$

(2)

$$\frac{7}{8} + \frac{7}{12} + \frac{13}{18} + \frac{11}{24} + \frac{19}{36} = \frac{126}{144} + \frac{84}{144} + \frac{117}{144} + \frac{88}{144} + \frac{114}{144} =$$

$$\frac{529}{144} = 3\frac{71}{144} \text{ Ans.}$$

(3)

$$\frac{3}{4} + \frac{5}{8} + \frac{9}{16} + \frac{5}{32} + \frac{15}{64} = \frac{48}{64} + \frac{40}{64} + \frac{36}{64} + \frac{10}{64} + \frac{15}{64} = \frac{149}{64} = 2\frac{1}{64} \text{ Ans.}$$

(4)

$$\frac{1}{16} + \frac{3}{7} + \frac{2}{8} + \frac{4}{9} = \frac{63}{1008} + \frac{432}{1008} + \frac{252}{1008} + \frac{448}{1008} = \frac{1195}{1008} = 1\frac{187}{1008}$$

(5)

$$\frac{1}{8} + (4\frac{1}{8}) = \frac{13}{8} + \frac{3}{8} = \frac{16}{8} = 2 \text{ Ans.}$$

(6)

$$\frac{3}{11} + \frac{5}{12} + \frac{13}{4} + \frac{2}{3} = \frac{36}{132} + \frac{55}{132} + \frac{429}{132} + \frac{88}{132} = \frac{608}{132} = 4\frac{29}{33} \text{ Ans.}$$

(7)

$$\frac{9}{17} + \frac{5}{12} + \frac{2}{3} + \frac{7}{8} = \frac{1080}{2040} + \frac{850}{2040} + \frac{816}{2040} + \frac{1785}{2040} = \frac{4531}{2040} = 2\frac{451}{2040}$$

(8)

$$\frac{13}{4} + \frac{27}{7} + \frac{7}{2} = \frac{91}{28} + \frac{88}{28} + \frac{98}{28} = \frac{277}{28} = 9\frac{25}{28} \text{ Ans.}$$

(9)

$$\frac{109}{25} + \frac{39}{5} + \frac{17}{24} + \frac{41}{15} = \frac{2582}{600} + \frac{4680}{600} + \frac{425}{600} + \frac{1640}{600} = \frac{9337}{600} = 15\frac{337}{600}$$

(10)

$$\frac{13}{5} + \frac{39}{8} + \frac{159}{40} = \frac{104}{40} + \frac{195}{40} + \frac{159}{40} = \frac{458}{40} = 11\frac{9}{20} \text{ Ans.}$$

(11)

$$\frac{43}{4} + \frac{29}{3} + \frac{52}{14} = \frac{1071}{84} + \frac{812}{84} + \frac{312}{84} = \frac{2195}{84} = 26\frac{11}{84} \text{ Ans.}$$

(12)

$$\frac{9}{10} \text{ of } 6\frac{7}{8} = \frac{9}{10} \text{ of } \frac{55}{8} = \frac{99}{16}; \quad \frac{2}{7} \text{ of } \frac{15}{2} = \frac{30}{7};$$

$$\frac{99}{16} + \frac{30}{7} = \frac{693}{112} + \frac{480}{112} = \frac{1173}{112} = 10\frac{53}{112} \text{ Ans.}$$

(13)

$$\frac{1}{5} \text{ of } \frac{75}{8} = \frac{15}{8}; \quad \frac{2}{3} \text{ of } \frac{37}{8} = \frac{37}{12};$$

$$\frac{15}{8} + \frac{37}{12} = \frac{180}{96} + \frac{296}{96} = \frac{476}{96} = 4\frac{31}{24} \text{ Ans.}$$

(14)

$$\frac{3}{8} + \frac{7}{8} + \frac{5}{8} = \frac{36}{110} + \frac{290}{110} + \frac{75}{110} = \frac{701}{110} = 6\frac{41}{110} \text{ Ans.}$$

(15)

$$\frac{35}{8} + \frac{9}{11} \text{ of } \frac{1}{6} \text{ of } \frac{31}{2} = \frac{35}{8} + \frac{93}{44} = \frac{385}{88} + \frac{186}{88} = \frac{571}{88} = 6\frac{43}{88} \text{ Ans.}$$

(16)

$$3\frac{5}{7} + 4\frac{5}{8} + \frac{1}{3} \text{ of } 16 = 3\frac{5}{7} + \frac{37}{8} + \frac{16}{3} = \frac{624}{168} + \frac{777}{168} + \frac{896}{168} = \frac{2297}{168} = 13\frac{13}{168} \text{ Ans.}$$

(17)

$$2 + 9 + 5 = 16; \frac{5}{8} + \frac{5}{8} + \frac{3}{4} = \frac{15}{4} + \frac{20}{4} + \frac{12}{4} = \frac{47}{4} = 2\frac{5}{4};$$

$$16 + 2\frac{5}{4} = 18\frac{5}{4} \text{ Ans.}$$

(18)

$$35 + 28 + 25 = 88; \frac{1}{3} + \frac{4}{7} + \frac{7}{21} = \frac{7}{21} + \frac{12}{21} + \frac{7}{21} = \frac{26}{21} = 1\frac{5}{21};$$

$$88 + 1\frac{5}{21} = 89\frac{5}{21} \text{ Ans.}$$

(19)

$$54 + 55 + 51 + 50 = 210; \frac{3}{4} + \frac{3}{8} + \frac{7}{16} + \frac{3}{2} = \frac{34}{16} + \frac{12}{16} + \frac{14}{16} + \frac{31}{2} = \frac{27}{2} + 210 = 212\frac{7}{2} \text{ Ans.}$$

(20)

$$3 + 7 + 5 = 15; \frac{7}{12} + \frac{4}{6} + \frac{3}{4} + \frac{1}{6} = \frac{21}{36} + \frac{16}{36} + \frac{27}{36} + \frac{6}{36} = \frac{70}{36} = 1\frac{7}{8};$$

$$15 + 1\frac{7}{8} = 16\frac{7}{8} \text{ Ans.}$$

(21)

$$22 + 20 + 21 = 63; \frac{5}{8} + \frac{7}{8} + \frac{1}{2} = \frac{10}{20} + \frac{10}{20} + \frac{10}{20} = \frac{30}{20} = 2\frac{61}{20};$$

$$63 + 2\frac{61}{20} = 65\frac{61}{20} \text{ Ans}$$

(22)

$$18+19+19+21+20=97; \frac{7}{12}+\frac{11}{20}+\frac{5}{9}+\frac{11}{15}+\frac{13}{18}= \\ \frac{105}{180}+\frac{99}{180}+\frac{100}{180}+\frac{132}{180}+\frac{130}{180}=\frac{566}{180}=3\frac{13}{90}; 3\frac{13}{90}+97=100\frac{13}{90}$$

(23)

$$17+25+46=88; \frac{3}{5}+\frac{2}{9}+\frac{8}{15}=\frac{27}{45}+\frac{10}{45}+\frac{24}{45}=\frac{61}{45}=1\frac{16}{45}; \\ 1\frac{16}{45}+88=89\frac{16}{45} \text{ Ans.}$$

(24)

$$112+9+225=346; \frac{6}{7}+\frac{5}{12}+\frac{9}{14}=\frac{72}{84}+\frac{35}{84}+\frac{54}{84}=\frac{161}{84}=1\frac{1}{12} \\ 346+1\frac{1}{12}=347\frac{1}{12} \text{ bu.}$$

$$250+62+104=416; \frac{4}{5}+\frac{3}{8}+\frac{7}{9}=\frac{288}{360}+\frac{135}{360}+\frac{280}{360}=1\frac{343}{360}; \\ 1\frac{343}{360}+416=417\frac{343}{360} \text{ Ans.}$$

(1)

$$\frac{2}{3} \text{ yd.} \times 3 \text{ ft.} \times 12 \text{ in.} = 2^7 \text{ in.} = 13\frac{1}{2} \text{ in.}; 13\frac{1}{2} \text{ in.} + \frac{5}{8} \text{ in.} = 14\frac{1}{8} \text{ in.}$$

(2)

$$\frac{1}{3} \text{ wk.} \times 7 \times 24 = 56 \text{ hr.}; \frac{1}{4} \text{ da.} \times 24 = 6 \text{ hr.}; \text{ then,} \\ 56 \text{ hr.} + 6 \text{ hr.} + \frac{1}{2} \text{ hr.} = 62\frac{1}{2} \text{ hr.} = 2 \text{ da. } 14\frac{1}{2} \text{ hr.} \text{ Ans.}$$

(3)

$$\frac{5}{8} \text{ cwt} \times 4 \times 25 \times 16 = 1000 \text{ oz.}; \frac{43}{6} \text{ lb.} \times 16 = 114\frac{2}{3} \text{ oz.}; 15 \text{ oz.}; \\ \frac{2}{3} \text{ cwt.} \times 4 \times 25 \times 16 = 1066\frac{2}{3} \text{ oz.}; 7 \text{ lb.} = 112 \text{ oz.}; 1000 + 114\frac{2}{3} + \\ 15 + 1066\frac{2}{3} + 112 = 2308\frac{1}{3} \text{ oz.} = 1 \text{ cwt. } 1 \text{ qr. } 19 \text{ lb. } 4\frac{1}{3} \text{ oz.}$$

(4)

$$\frac{1}{3} \text{ lb. Troy} = 2 \text{ oz. } 8 \text{ pwt.}; \frac{1}{8} \text{ oz.} = 2 \text{ pwt. } 12 \text{ gr.}; \\ 2 \text{ oz. } 8 \text{ pwt.} + 2 \text{ pwt. } 12 \text{ gr.} = 2 \text{ oz. } 10 \text{ pwt. } 12 \text{ gr.} \text{ Ans.}$$

(5)

$$\frac{4}{9} \text{ of a ton} = 8 \text{ cwt. } 3 \text{ qr. } 13 \text{ lb. } 14\frac{2}{3} \text{ oz.}; \\ \frac{5}{12} \text{ of a cwt.} = \frac{1 \text{ qr. } 16 \text{ lb. } 10\frac{2}{3} \text{ oz.}}{9 \text{ cwt. } 1 \text{ qr. } 5 \text{ lb. } 8\frac{2}{3} \text{ oz.} \text{ Ans.}}$$

(6)

 $\frac{2}{3}$ of a chal.=20 bushels ; $\frac{2}{3}$ of a bush.= 1 pk. $5\frac{1}{3}$ qt.

20 bu. 1 pk. $5\frac{1}{3}$ qt. *Ans.*

(7)

 $\frac{2}{3}$ of a tun=3 hhd. $\frac{2}{3}$ of a hhd.= 37 gal. 3 qt. 0 pt. $1\frac{1}{2}$ gi.

3 hhd. 37 gal. 3 qt. 0 pt. $1\frac{1}{2}$ gi. *Ans.*

(8)

 $\frac{1}{2}$ of $\frac{3}{4}$ of a common year=54 da. 18 hr. $\frac{2}{3}$ of $\frac{5}{8}$ of a day = 5 hr. $\frac{1}{5}$ of $\frac{2}{3}$ of $\frac{3}{8}$ of $19\frac{1}{2}$ hr. = 3 hr. 47 min. 30 sec.

55 da. 2 hr. 47 min. 30 sec.

(9)

 $\frac{5}{8}$ of an acre=2 R. 20 P. $\frac{2}{3}$ of 19 sq. ft.= 11 sq. ft. $57\frac{2}{3}$ sq. in. $\frac{1}{4}$ of a sq. in.= $\frac{1}{4}$ sq. in.

2 R. 20 P. 11 sq. ft. $58\frac{1}{3}$ sq. in. *Ans.*

(10)

 $\frac{1}{4}$ of a yard= $5\frac{1}{4}$ inches $\frac{1}{4}$ of a foot= $1\frac{1}{4}$ " $\frac{1}{4}$ of an inch= $\frac{1}{4}$ "

7 inches. *Ans.*

(11)

 $\frac{2}{3}$ of a £ =13s. 4d. $\frac{5}{8}$ of a shilling= $6\frac{1}{4}$ d.

13s. $10\frac{1}{4}$ d. *A.*

(12)

 $\frac{1}{8}$ of a mile=7 fur. $\frac{2}{3}$ of a yard= 2 ft. $\frac{3}{4}$ of a foot=9 in.7 fur. 2 ft. 9 in. *Ans.*

(13)

 $\frac{3}{4}$ of a leap year = 219 da. 14 hr. 24 min. $\frac{1}{3}$ of a week = 2 da. 8 hr. $\frac{1}{4}$ of a day = 3 hr.

222 da. 1 hr. 24 min. *Ans.*

(14)

 $\frac{3}{4}$ of a pound Troy = 7 oz. 4 pwt. $\frac{1}{2}$ of an ounce = 3 pwt. 8 gr. $\frac{1}{4}$ of a pennyweight = 15 gr.

7 oz. 7 pwt. 23 gr. *Ans.*

(15)

 $\frac{3}{4}$ of a Circle = 1 sign 26° 50' 31 $\frac{1}{2}$ " $3\frac{1}{2}$ signs = 3 signs 18° 45' $\frac{2}{3}$ of a degree = 40' $\frac{2}{5}$ of 5 $\frac{1}{4}$ minutes = 1' 84"

5 signs 16° 16' 40 $\frac{29}{133}$ " *Ans.*

(16)

 $\frac{1}{2}$ of a yard = 3 qr. 2 na. $\frac{3}{4}$ of $\frac{1}{2}$ of a quarter = 1 $\frac{1}{2}$ na. $3\frac{1}{2}$ nails = 3 $\frac{1}{2}$ na.

1 yd. 0 qr. 2 $\frac{5}{8}$ na. *Ans.*

(17)

 $\frac{3}{4}$ of a cord = 1 cord ft. 9 cu. ft. $\frac{5}{8}$ of a cubic foot = 960 cu. in. $\frac{2}{3}$ of $\frac{1}{2}$ of 24 $\frac{2}{3}$ cu. ft. = 2 cu. ft. 1234 $\frac{2}{3}$ cu. in.

1 cord ft. 11 cu. ft. 466 $\frac{2}{3}$ cu. in. *A.*

(18)

$$\frac{3}{4} \text{ of } \frac{1}{2} \text{ of } 4 \text{ cords} = 1 \text{ cord } 4 \text{ cord ft.}$$

$$\frac{5}{8} \text{ of } \frac{9}{16} \text{ of } 15 \text{ cord ft.} = \quad 7 \quad " \quad 0 \text{ cu. ft. } 864 \text{ cu. in.}$$

$$\frac{5}{9} \text{ of } 31\frac{1}{2} \text{ cu. ft.} = \quad 1 \quad " \quad 1 \quad " \quad 864 \quad "$$

$$2 \text{ cords } 4 \text{ cord ft. } 2 \text{ cu. ft. } \textit{Ans.}$$

(19)

$$\frac{1}{3} \text{ of } 3 \text{ E. E.} = 3 \text{ yd. } 0 \text{ qr. } 2 \text{ na.}$$

$$\frac{1}{12} \text{ of a yard} = \quad 1 \text{ qr. } 2\frac{1}{2} \text{ na.}$$

$$3 \text{ yd. } 2 \text{ qr. } 0\frac{1}{2} \text{ na. } \textit{Ans.}$$

(20)

$$\frac{1}{3} \text{ of } 3 \text{ A. } 1 \text{ R. } 20 \text{ P.} = 2 \text{ A. } 2 \text{ R. } 32 \text{ P.}$$

$$\frac{2}{3} \text{ of an acre} = \quad 1 \text{ R. } 20 \text{ P.}$$

$$\frac{2}{3} \text{ of } 3 \text{ R. } 15 \text{ P.} = \quad 2 \text{ R. } 21\frac{1}{2} \text{ P.}$$

$$3 \text{ A. } 2 \text{ R. } 33\frac{1}{4} \text{ P. } \textit{Ans.}$$

(21)

$$\frac{7}{12} \text{ of a ton} = 11 \text{ cwt. } 2 \text{ qr. } 16 \text{ lb. } 10 \text{ oz. } 10\frac{1}{2} \text{ dr.}$$

$$\frac{2}{10} \text{ of a cwt.} = \quad 1 \text{ qr. } 5 \text{ lb.}$$

$$\frac{5}{12} \text{ of an ounce} = \quad \quad \quad 6\frac{1}{2} \text{ dr.}$$

$$11 \text{ cwt. } 3 \text{ qr. } 21 \text{ lb. } 11 \text{ oz. } 1\frac{1}{2} \text{ dr. } \textit{Ans.}$$

(22)

$$\frac{1}{2} \text{ of } \frac{2}{3} \text{ of a mile} = 2 \text{ fur. } 16 \text{ rd.}$$

$$\frac{2}{3} \text{ of a furlong} = \quad 24 \text{ rd.}$$

$$\frac{4}{33} \text{ of a rod} = \quad \quad \quad 2 \text{ ft.}$$

$$\frac{1}{2} \text{ of a foot} = \quad \quad \quad 6 \text{ in.}$$

$$3 \text{ fur. } 0 \text{ rd. } 2 \text{ ft. } 6 \text{ in. } \textit{Ans.}$$

SUBTRACTION.

$$(1) \quad \frac{2}{7} - \frac{1}{7} = \frac{1}{7}$$

$$(2) \quad \frac{14}{19} - \frac{11}{19} = \frac{3}{19}$$

$$(3) \quad \frac{16}{23} - \frac{12}{23} = \frac{4}{23}$$

$$(4) \quad \frac{204}{303} - \frac{104}{303} = \frac{100}{303} = \frac{20}{61}$$

$$(5) \quad \frac{9}{7} - \frac{4}{7} = \frac{30}{35} - \frac{28}{35} = \frac{2}{35}$$

$$(6) \quad 1\frac{1}{2} - \frac{13}{16} = 1\frac{8}{16} - \frac{13}{16} = \frac{20}{16} = \frac{5}{4}$$

$$(7) \quad \frac{14}{15} - \frac{12}{15} = \frac{182}{195} - \frac{180}{195} = \frac{2}{195}$$

$$(8) \quad 37\frac{11}{15} - \frac{1}{3} \text{ of } 5\frac{5}{8} = \frac{566}{15} - \frac{35}{15} = \frac{3396}{90} - \frac{175}{90} = \frac{3221}{90} = 35\frac{71}{90}$$

$$(9) \quad \frac{3}{4} - \frac{5}{9} = \frac{27}{36} - \frac{20}{36} = \frac{7}{36}$$

$$(10) \quad \frac{7}{8} - \frac{5}{18} = \frac{126}{144} - \frac{40}{144} = \frac{86}{144} = \frac{43}{72}$$

$$(11) \quad \frac{25}{1} - \frac{11}{15} = \frac{375}{15} - \frac{11}{15} = \frac{364}{15} = 24\frac{4}{15}$$

$$(12) \quad \frac{6}{15} \text{ of } 3 - \frac{1}{3} \text{ of } \frac{4}{9} = \frac{6}{5} - \frac{4}{27} = \frac{162}{135} - \frac{20}{135} = \frac{142}{135} = 1\frac{7}{135}$$

$$(13) \quad \frac{1}{7} \text{ of } \frac{6}{3} \text{ of } \frac{7}{1} - \frac{3}{8} = \frac{1}{2} - \frac{3}{8} = \frac{4}{8} - \frac{3}{8} = \frac{1}{8}$$

$$(14) \quad 3\frac{5}{8} - \frac{2}{3} \text{ of } \frac{7}{8} = \frac{29}{8} - \frac{7}{12} = \frac{87}{24} - \frac{14}{24} = \frac{73}{24} = 3\frac{1}{24}$$

$$(15) \quad \frac{2}{3} \text{ of } \frac{15}{1} - \frac{4}{5} \text{ of } \frac{3}{1} = \frac{10}{1} - \frac{12}{5} = \frac{50}{5} - \frac{12}{5} = \frac{38}{5} = 7\frac{3}{5}$$

$$(16) \quad \frac{44}{5} - \frac{1}{15} = \frac{220}{15} - \frac{1}{15} = \frac{219}{15} = 14\frac{3}{5}$$

(17)

$$\frac{4}{5} - \frac{2}{5} = \frac{24}{40} - \frac{16}{40} = \frac{8}{40}$$

(18)

$$5 - 1\frac{7}{8} = \frac{40}{8} - \frac{14}{8} = \frac{26}{8} = 3\frac{2}{8}$$

(19)

$$17\frac{3}{5} - 7\frac{2}{5} = \frac{88}{5} - \frac{36}{5} = \frac{52}{5} = 10\frac{2}{5} \text{ Ans.}$$

(20)

$$3\frac{5}{8} + 10\frac{4}{8} = 14\frac{9}{8}; 25\frac{1}{4} - 17\frac{1}{20} = 7\frac{1}{20}; 14\frac{1}{4} - 7\frac{1}{20} = 6\frac{3}{10} \text{ Ans.}$$

(21)

$$9 - \frac{2}{5} \text{ of } \frac{7}{8} = 9 - \frac{14}{40}; 8\frac{1}{10} + \frac{1}{2} \text{ of } \frac{4}{5} = \frac{32}{10} + \frac{2}{10} = \frac{34}{10} = 3\frac{4}{10} \text{ Ans.}$$

(22)

$$\frac{2}{3} \text{ of } \frac{4}{5} = \frac{8}{15}; \frac{1}{2} \text{ of } \frac{5}{8} = \frac{5}{16}; \frac{5}{12} \text{ of } \frac{8}{15} = \frac{2}{3} \text{ of the whole vessel sold;}$$

$$\frac{8}{15} - \frac{2}{3} = \frac{1}{15} \text{ the part left.}$$

(23)

$$\frac{1}{2} \text{ of } \frac{4}{5} \text{ of } \frac{9}{10} \text{ of } \frac{490}{10} = \$120; \frac{6}{7} \text{ of } \frac{1}{2} \text{ of } \frac{3}{4} \text{ of } \frac{1680}{10} = \$192;$$

$$192 - 120 = \$72 \text{ Ans.}$$

(24)

$$2\frac{1}{4} - 1\frac{7}{8} = \frac{5}{4} - \frac{14}{8} = \frac{5}{8} - \frac{7}{8} = -\frac{2}{8} \text{ Ans.}$$

(25)

$$31\frac{1}{2} - 12\frac{5}{7} = \frac{62}{2} - \frac{25}{2} = \frac{37}{2} = 18\frac{1}{2} \text{ Ans.}$$

(26)

$$10\frac{3}{4} + 24\frac{4}{8} = 35\frac{1}{2} \text{ cords; } 35\frac{1}{2} - 16\frac{7}{8} = 18\frac{3}{8} \text{ cords. Ans}$$

(27)

$$54\frac{9}{10} + 56\frac{1}{2} = 111\frac{19}{20}; 43\frac{1}{3} + 34\frac{1}{2} = 78\frac{2}{3}; 111\frac{19}{20} - 78\frac{2}{3} =$$

$$33\frac{3}{20} \text{ pounds. Ans.}$$

(28)

$$15\frac{7}{16} + 12\frac{7}{8} = 28\frac{5}{16}; 50\frac{1}{2} - 28\frac{5}{16} = 22\frac{3}{8} \text{ Ans.}$$

(29)

$$\frac{1}{2} + \frac{1}{4} = \frac{3}{4}; \frac{3}{4} - \frac{2}{5} = \frac{3}{10} \text{ Ans.}$$

(30)

$$27\frac{1}{2} + 32\frac{1}{8} = 59\frac{1}{4}; 59\frac{1}{4} - 40\frac{1}{8} = 18\frac{3}{8} \text{ Ans.}$$

(2)

$$\frac{1}{2} - \frac{1}{3} = \frac{1}{6} = \frac{2}{12}$$

(3)

$$\frac{1}{4} - \frac{1}{5} = \frac{1}{20}$$

(4)

$$\frac{1}{9} - \frac{1}{20} = \frac{1}{180}$$

(5)

$$\frac{1}{27} - \frac{1}{30} = \frac{1}{270}$$

(2)

$$\begin{array}{r} 14\frac{7}{9} = 14\frac{76}{81} \\ 12\frac{6}{9} = 12\frac{42}{81} \\ \hline 2\frac{34}{81} \end{array}$$

(3)

$$\begin{array}{r} 115\frac{8}{9} \\ 39\frac{7}{9} \\ \hline 76\frac{1}{9} \end{array}$$

(4)

$$\begin{array}{r} 78\frac{3}{16} = 78\frac{6}{32} \\ 4\frac{7}{32} = 4\frac{7}{32} \\ \hline 73\frac{31}{32} \end{array}$$

(5)

$$\begin{array}{r} 48\frac{5}{9} = 48\frac{10}{18} \\ 41\frac{15}{18} = 41\frac{15}{18} \\ \hline 6\frac{25}{18} \end{array}$$

(6)

$$\begin{array}{r} 287\frac{5}{25} = 287\frac{20}{100} \\ 104\frac{37}{100} = 104\frac{37}{100} \\ \hline 182\frac{57}{100} \end{array}$$

(1)

$$\begin{array}{l} \frac{1}{2} \text{ of a pound} = 10 \text{ oz. } 0 \text{ pwt. } 0 \text{ gr.} \\ \frac{1}{4} \text{ of an ounce} = \frac{12 \text{ pwt. } 12 \text{ gr.}}{9 \text{ oz. } 7 \text{ pwt. } 12 \text{ gr.}} \text{ Ans.} \end{array}$$

(2)

$$\begin{array}{l} \frac{1}{2} \text{ of a ton} = 7 \text{ cwt. } 2 \text{ qr. } 0 \text{ lb. } 0 \text{ oz.} \\ \frac{1}{2} \text{ of } \frac{1}{4} = \frac{1}{8} \text{ lb.} = \frac{8 \text{ oz.}}{7 \text{ cwt. } 1 \text{ qr. } 24 \text{ lb. } 8 \text{ oz.}} \text{ Ans.} \end{array}$$

(3)

$$\frac{2}{3} \text{ of } \frac{5}{7} \text{ of a hhd.} = \frac{10}{21} \text{ hhd.} = 30 \text{ gal.}$$

$$\frac{2}{3} \text{ of } \frac{1}{2} \text{ of a qt.} = \frac{1}{3} \text{ qt.}$$

$$29 \text{ gal. } 3\frac{1}{3} \text{ qt.}$$

(4)

$$\frac{2}{3} \text{ of a L.} = 1 \text{ mi. } 6 \text{ fur. } 16 \text{ rd}$$

$$\frac{1}{3} \text{ of a mile} = \frac{5}{1} \text{ fur.}$$

$$1 \text{ mi. } 1 \text{ fur. } 16 \text{ rd. } \textit{Ans.}$$

(5)

$$1\frac{2}{3} \text{ shillings} = 1 \text{ s. } 8 \text{ d.}$$

$$\frac{2}{3} \text{ of } 7\frac{1}{2} \text{ d.} = 5 \text{ d.}$$

$$1 \text{ s. } 3 \text{ d. } \textit{Ans.}$$

(6)

$$2\frac{1}{3} \text{ of a degree} = 45'$$

$$\frac{2}{3} \text{ of } \frac{1}{4} \text{ of a deg.} = 6' 25\frac{1}{2}''$$

$$38' 34\frac{1}{2}''$$

(7)

$$\frac{1}{8} \text{ of square mile} = 600 \text{ A.}$$

$$36\frac{1}{2} \text{ acres} = 36 \text{ A. } 3 \text{ R. } 4\frac{1}{2} \text{ P.}$$

$$563 \text{ A. } 0 \text{ R. } 35\frac{1}{2} \text{ P. } \textit{Ans.}$$

(8)

$$\frac{9}{10} \text{ of a ton} = 17 \text{ cwt. } 0 \text{ qr. } 14 \text{ lb. } 4\frac{1}{2} \text{ oz.}$$

$$\frac{2}{3} \text{ of } 12 \text{ cwt.} = 6 \text{ cwt. } 2 \text{ qr. } 16 \text{ lb. } 10\frac{2}{3} \text{ oz.}$$

$$10 \text{ cwt. } 1 \text{ qr. } 22 \text{ lb. } 9\frac{1}{2}\frac{2}{3} \text{ oz. } \textit{Ans.}$$

(9)

$$1\frac{3}{4} \text{ pound Troy} = 1 \text{ lb. } 9 \text{ oz. } 0 \text{ pwt. } 0 \text{ gr.}$$

$$\frac{1}{8} \text{ of an ounce} = \frac{3 \text{ pwt. } 8 \text{ gr.}}{1 \text{ lb. } 8 \text{ oz. } 16 \text{ pwt. } 16 \text{ gr.}}$$

(10)

$$2\frac{3}{4} \text{ cords} = 2 \text{ cords } 3 \text{ C. ft. } 0 \text{ cu. ft.}$$

$$\frac{3}{4} \text{ of a cord ft.} = \frac{12 \text{ cu. ft.}}{2 \text{ cords } 2 \text{ C. ft. } 4 \text{ cu. ft. } \textit{Ans.}}$$

(11)

 $\frac{1}{8}$ of a yard = 6 in. $\frac{2}{3}$ of an inch = $\frac{2}{3}$ in. $5\frac{1}{3}$ in.

(12)

 $\frac{1}{2}$ of $\frac{2}{3}$ of lb = $4\frac{2}{3}$ 4 3 0 D 0 gr. $\frac{2}{3}$ of $\frac{1}{2}$ of 3 = 16 gr.4 $\frac{2}{3}$ 3 3 2 D 4 gr. *Ans.*

(13)

 $2\frac{5}{16}$ A. = 2 A. 1 R. 19 P. 0 sq. yd.1 " 0 " 1 " 9 "1 A. 1 R. 17 P. $21\frac{1}{4}$ sq. yd. *Ans.*

(14)

1 oz. Avoirdupois = $\frac{1}{16}$ of 14 oz. 11 pwt. 16 gr. Troy =437 $\frac{1}{2}$ gr. Troy ; 1 oz. Troy = 480 gr. Troy ; $480 - 437\frac{1}{2} = 1$ pwt. $18\frac{1}{2}$ gr.

MULTIPLICATION.

(1)

$$\frac{2}{7} \times 8 = \frac{16}{7} = 2\frac{2}{7}$$

(2)

$$\frac{8}{25} \times \frac{12}{1} = \frac{96}{25} = 3\frac{16}{25}$$

(3)

$$\frac{32}{40} \times \frac{9}{1} = \frac{288}{40} = 7\frac{1}{5}$$

(4)

$$\frac{14}{15} \times \frac{15}{1} = \frac{210}{15} = 14$$

(5)

$$\frac{4}{5} \text{ of } \frac{4}{7} \times \frac{35}{1} = 16$$

$$(6) \quad 1\frac{3}{4} \text{ of } 2\frac{1}{2} \times 16 = \frac{7}{4} \times \frac{5}{2} \times \frac{16}{1} = 70$$

$$(7) \quad 2\frac{1}{2} \text{ of } \frac{7}{4} \times \frac{10}{1} = \frac{11}{5} \text{ of } \frac{2}{7} \times \frac{70}{1} = 44$$

$$(8) \quad 4\frac{3}{4} \text{ of } \frac{8}{1} \times 36 = \frac{33}{8} \times \frac{8}{1} \times \frac{36}{1} = 1584$$

$$(9) \quad 67 \times \frac{100}{12} = 7\frac{19}{12} = 608\frac{7}{12}$$

$$(10) \quad 34^2 \times \frac{6}{5} = \frac{52888}{5} = 5987\frac{3}{5}$$

$$(11) \quad \frac{72}{1} \times \frac{63}{5} = 4536$$

$$(12) \quad \frac{115}{160} \times \frac{47}{4} = 5405$$

$$(13) \quad \frac{155}{220} \times \frac{45}{4} = 6975$$

$$(14) \quad \frac{335}{1340} \times \frac{35}{4} = 11725$$

$$(15) \quad \frac{8}{3} \times \frac{8}{1} = \frac{32}{3} = 3\frac{2}{3}$$

$$(16) \quad \frac{15}{1} \times \frac{8}{7} = \frac{80}{7} = 12\frac{4}{7}$$

$$(17) \quad 7\frac{7}{8} \times 8 = \frac{63}{8} \times \frac{8}{1} = 63$$

$$(18) \quad 9\frac{1}{2} \times 18\frac{3}{4} = \frac{19}{2} \times \frac{75}{4} = \frac{1425}{8} = 178\frac{1}{8}$$

$$(19) \quad 3\frac{7}{8} \times 4\frac{1}{3} = \frac{23}{8} \times \frac{14}{3} = \frac{322}{24} = 13\frac{1}{3}$$

$$(20) \quad \frac{175}{81} \times \frac{9}{1} = \frac{175}{9} = 19\frac{4}{9}$$

$$(21) \quad \frac{7}{8} \times \frac{3}{5} = \frac{21}{40}$$

$$(22) \quad \frac{1}{4} \text{ of } \frac{3}{8} \times \frac{5}{9} = \frac{5}{96}$$

(23)

$$\frac{5}{12} \times \frac{9}{20} \text{ of } \frac{1}{27} = \frac{1}{14}$$

(24)

$$\frac{1}{2} \text{ of } \frac{7}{8} \times \frac{4}{7} \text{ of } \frac{3}{10} = \frac{3}{20}$$

(25)

$$\frac{7}{8} \times \frac{16}{1} = 14$$

(26)

$$\frac{2}{1} \times \frac{9}{14} = 18$$

(27)

$$8\frac{7}{10} \times 15 = \frac{87}{10} \times \frac{15}{1} = \frac{261}{2} = 130\frac{1}{2}$$

(28)

$$\frac{2}{11} \text{ of } \frac{5}{3} \times \frac{10}{24} = \frac{5}{3}$$

(29)

$$5\frac{1}{4} \times \frac{4}{3} \text{ of } 3\frac{1}{3} = \frac{21}{4} \times \frac{4}{3} \text{ of } \frac{10}{3} = 14$$

(30)

$$842\frac{1}{4} \times 7\frac{1}{2} = \frac{3369}{4} \times \frac{15}{2} = \frac{50535}{8} = 6316\frac{1}{8}$$

(31)

$$\frac{5}{3} \times \frac{6}{7} = \frac{10}{7}$$

(32)

$$\frac{9}{10} \times \frac{42}{11} = \frac{378}{55} = 6\frac{18}{11}$$

(33)

$$\frac{7}{11} \times \frac{22}{23} \times \frac{46}{49} = \frac{4}{7}$$

(34)

$$\frac{14}{27} \times \frac{1}{28} \times \frac{6}{13} \times \frac{26}{30} = \frac{1}{15}$$

(35)

$$\frac{12}{17} \times \frac{2}{9} \times \frac{17}{1} = \frac{8}{3} = 2\frac{2}{3}$$

(36)

$$\frac{6}{1} \times \frac{2}{3} \text{ of } \frac{5}{1} = 20$$

(37)

$$\frac{1}{8} \text{ of } \frac{1}{6} \text{ of } \frac{3}{1} \times \frac{106}{7} = \frac{53}{28}$$

$$(38) \quad \frac{2}{9} \text{ of } \frac{3}{5} \times \frac{5}{8} \text{ of } \frac{23}{7} = \frac{69}{252} = \frac{23}{84}$$

$$(39) \quad \frac{5}{1} \times \frac{2}{3} \times \frac{2}{7} \text{ of } \frac{3}{5} \times \frac{25}{6} = \frac{50}{21} = 2\frac{8}{21}$$

$$(40) \quad \frac{3}{4} \times \frac{7}{1} = 2\frac{1}{4} = \$5\frac{1}{4}$$

$$(41) \quad \frac{2}{7} \times \frac{51}{4} = \frac{102}{7} = \$14\frac{4}{7}$$

$$(42) \quad \frac{2}{9} \times \frac{3}{8} = \frac{1}{12}$$

$$(43) \quad \frac{5}{8} \times \frac{9}{1} = \frac{45}{8} = 11\frac{1}{8} \text{ tons.}$$

$$(44) \quad \frac{15}{8} \times \frac{24}{1} = \frac{45}{2} = \$22\frac{1}{2}$$

$$(45) \quad \frac{7}{5} \times \frac{1}{2} = \frac{7}{10} = \$3\frac{1}{2}$$

$$(46) \quad \frac{4}{1} \times \frac{11}{2} = \frac{44}{2} = \$22$$

$$(47) \quad 1\frac{1}{4} \times 6\frac{1}{8} = \frac{5}{4} \times \frac{49}{8} = \frac{245}{32} = \$7\frac{21}{32}$$

$$(48) \quad 2\frac{1}{2} \times 3\frac{3}{8} = \frac{5}{2} \times \frac{27}{8} = \frac{135}{8} = \$16\frac{7}{8}$$

$$(49) \quad \frac{5}{1} \times \frac{11}{25} = 55 \text{ cents.}$$

$$(50) \quad 75\frac{8}{15} \times \frac{5}{11} = \frac{103}{15} \times \frac{5}{11} = \frac{103}{3} = \$34\frac{1}{3}$$

$$(51) \quad 2\frac{1}{2} \times 17\frac{1}{2} = \frac{5}{2} \times \frac{35}{2} = \frac{175}{4} = 43\frac{3}{4} \text{ shillings.}$$

$$(52) \quad 20\frac{1}{2} \times 15\frac{5}{8} = \frac{404}{8} \times \frac{125}{8} = \$325$$

(53)

$$\frac{5}{\frac{5}{3}} \times \frac{2}{3} = \frac{2}{3}$$

(54)

$$\frac{7}{\frac{7}{5}} \times \frac{3}{\frac{3}{2}} = \frac{3}{2}$$

(55)

$$\frac{9}{\frac{9}{2}} \times \frac{5}{\frac{5}{4}} = \frac{3}{8}$$

(56)

$$\frac{2}{3} \text{ of } \frac{11}{\frac{11}{6}} \times \frac{4}{5} \text{ of } \frac{15}{\frac{15}{4}} = \frac{11}{24}$$

(57)

$$9\frac{3}{4} \times \frac{2}{3} \text{ of } 3\frac{1}{2} = \frac{13}{\frac{13}{4}} \times \frac{2}{3} \text{ of } \frac{7}{5} = \frac{104}{5} = 20\frac{4}{5}$$

(58)

$$22\frac{1}{2} \times \frac{5}{8} = \frac{45}{2} \times \frac{5}{8} = \frac{25}{2} = 12\frac{1}{2} \text{ days.}$$

(59)

$$\frac{1}{20} \times 106\frac{2}{3} = \frac{1}{20} \times \frac{16}{3} = \frac{16}{3} = 5\frac{1}{3} \text{ hours.}$$

(60)

$$\frac{7}{8} \times \frac{4}{5} = \frac{7}{10} = \text{B's share before selling ;}$$

$$\frac{7}{10} \times \frac{5}{9} = \frac{7}{18} = \text{C's share before selling ;}$$

$$\frac{7}{10} \times \frac{1}{4} = \frac{7}{40} = \text{D's share.}$$

(61)

$$\frac{40}{200} \times \frac{3}{5} = 120 \text{ A.} = \text{what A owned;} \\ \frac{1}{1} \times \frac{3}{5} = 120 \text{ A.} = \text{what A owned;} \\ \frac{40}{120} \times \frac{2}{3} = 80 \text{ A.} = \text{what A sold;} \\ \frac{20}{80} \times \frac{1}{4} = 20 \text{ A.} = \text{what B sold to C.}$$

$$\frac{40}{120} \times \frac{2}{3} = 80 \text{ A.} = \text{what A sold;} \\ \frac{20}{80} \times \frac{1}{4} = 20 \text{ A.} = \text{what B sold to C.}$$

$$\frac{20}{80} \times \frac{1}{4} = 20 \text{ A.} = \text{what B sold to C.}$$

DIVISION.

(1)

$$\frac{3}{11} \div \frac{1}{7} = \frac{21}{115} \times \frac{1}{7} = \frac{3}{11}$$

(2)

$$\frac{2}{14} \div \frac{1}{14} = \frac{2}{14} \times \frac{14}{1} = \frac{2}{1}$$

(4)

$$\frac{120}{319} \div \frac{1}{40} = \frac{120}{319} \times \frac{40}{1} = \frac{4800}{319}$$

(3)

$$\frac{1}{13} \div \frac{1}{13} = \frac{1}{13} \times \frac{13}{1} = 1$$

(6)

$$\frac{1}{1} \div \frac{1}{10} = \frac{1}{1} \times \frac{10}{1} = 10$$

(5)

$$\frac{23}{24} \div \frac{1}{13} = \frac{23}{24} \times \frac{13}{1} = \frac{299}{24}$$

(7)

$$\frac{27}{1} \div \frac{3}{4} = \frac{27}{1} \times \frac{4}{3} = 36$$

(8)

$$\frac{1}{8} \div \frac{1}{7} = \frac{1}{8} \times \frac{7}{1} = \frac{7}{8}$$

(9)

$$\frac{3}{10} \div \frac{3}{8} = \frac{3}{10} \times \frac{8}{3} = \frac{24}{30} = \frac{4}{5}$$

(10)

$$\frac{15}{16} \div \frac{1}{14} = \frac{15}{16} \times \frac{14}{1} = \frac{210}{16} = \frac{105}{8}$$

(11)

$$\frac{3}{8} \text{ of } \frac{4}{5} \div \frac{3}{7} \text{ of } \frac{3}{4} = \frac{\frac{3}{8} \times \frac{4}{5}}{\frac{3}{7} \times \frac{3}{4}} = \frac{\frac{12}{40}}{\frac{9}{28}} = \frac{12}{9} \times \frac{28}{40} = \frac{112}{150} = \frac{56}{75}$$

(12)

$$\frac{7}{8} \text{ of } \frac{6}{7} \div \frac{4}{5} \text{ of } \frac{8}{9} = \frac{\frac{7}{8} \times \frac{6}{7}}{\frac{4}{5} \times \frac{8}{9}} = \frac{\frac{42}{56}}{\frac{32}{45}} = \frac{42}{32} \times \frac{45}{56} = \frac{1575}{1792} = 1 \frac{7}{128}$$

(13)

$$\frac{3}{8} \text{ of } \frac{2}{3} \div \frac{3}{4} \text{ of } \frac{5}{6} = \frac{\frac{3}{8} \times \frac{2}{3}}{\frac{3}{4} \times \frac{5}{6}} = \frac{\frac{2}{8}}{\frac{15}{24}} = \frac{2}{8} \times \frac{24}{15} = \frac{48}{120} = \frac{2}{5}$$

(14)

$$56 \div 1\frac{1}{2} = 56 \times \frac{2}{3} = \frac{112}{3} = 37\frac{2}{3}$$

(15)

$$1000 \div 133 = \frac{1000}{133} = \frac{1000 \times 25}{133 \times 25} = \frac{25000}{3325} = 7\frac{325}{3325} = 7\frac{13}{133}$$

(16)

$$125 \div 25 = \frac{125}{25} = 5$$

(17)

$$4\frac{3}{8} \div 5 = \frac{35}{8} \div 5 = \frac{35}{8} \times \frac{1}{5} = \frac{7}{8}$$

(18)

$$9\frac{5}{11} \div 12 = \frac{104}{11} \div 12 = \frac{104}{11} \times \frac{1}{12} = \frac{26}{33}$$

(19)

$$\frac{1}{3} \text{ of } \frac{33}{2} \div \frac{29}{7} = \frac{11}{2} \div \frac{29}{7} = \frac{11}{2} \times \frac{7}{29} = \frac{77}{58} = 1\frac{19}{58}$$

(20)

$$9\frac{1}{3} \div \frac{1}{2} \text{ of } \frac{7}{1} = \frac{55}{3} \div \frac{7}{2} = \frac{55}{3} \times \frac{2}{7} = \frac{110}{21} = 5\frac{5}{21}$$

$$\frac{5}{\cancel{6}} \text{ of } \frac{\overset{25}{\cancel{50}}}{1} \div \frac{13}{3} = \frac{125}{\cancel{3}} \times \frac{\cancel{3}}{13} = \frac{125}{13} = 9\frac{8}{13}$$

$$\text{(22)} \quad 300\frac{5}{\cancel{28}} \div 6\frac{1}{4} = \frac{\overset{1681}{\cancel{8405}}}{\cancel{28}} \times \frac{\cancel{4}}{\cancel{25}} = \frac{1681}{35} = 48\frac{1}{35}$$

$$\text{(23)} \quad \frac{\cancel{4}}{7} \text{ of } \frac{15}{\cancel{4}} \div \frac{19}{\cancel{20}} \text{ of } \frac{\overset{3}{\cancel{15}}}{2} = \frac{\overset{5}{\cancel{15}}}{7} \times \frac{8}{\cancel{57}} = 1\frac{4}{19}$$

$$\text{(24)} \quad 9\frac{7}{8} \div 8\frac{1}{3} = \frac{79}{8} \times \frac{3}{25} = \frac{237}{200} = 1\frac{37}{200} \quad \text{(25)} \quad \frac{7}{8} \text{ of } \frac{7}{11} \div 6\frac{1}{6} = \frac{\cancel{35}}{\cancel{44}} \times \frac{\cancel{6}}{\cancel{55}} = 1\frac{7}{11}$$

$$\text{(26)} \quad 1\frac{3}{4} \div \frac{1}{4} = \frac{\cancel{12}}{17} \times \frac{1}{\cancel{4}} = \frac{3}{17} \quad \text{(27)} \quad 39 \div 5 = \frac{20+19}{27} = 1\frac{19}{27}$$

$$\text{(28)} \quad \frac{\cancel{48}}{72} \div 8 = \frac{\cancel{60}}{75} \times \frac{1}{\cancel{6}} = \frac{1}{10} \quad \text{(29)} \quad 132 \div 48 = \frac{432+48}{521} = 1\frac{2}{11}$$

$$\text{(30)} \quad \frac{42}{125} \div 21 = 1\frac{2}{25} \quad \text{(31)} \quad \frac{36}{15} \div \frac{9}{10} = \frac{\overset{4}{\cancel{36}}}{1} \times \frac{10}{\cancel{9}} = 40$$

r*

$$(32) \quad \frac{420}{1} \div \frac{3}{8} = \frac{140}{1} \times \frac{8}{3} = 1120$$

$$(33) \quad \frac{9}{20} \div \frac{3}{8} = \frac{9}{20} \times \frac{8}{3} = \frac{6}{5} = 1\frac{1}{5}$$

$$(34) \quad \frac{14}{3} \div \frac{7}{5} = \frac{14}{3} \times \frac{5}{7} = \frac{6}{5} = 1\frac{1}{5}$$

$$(35) \quad \frac{2}{3} \text{ of } \frac{27}{50} \div \frac{20}{27} = \frac{9}{25} \times \frac{27}{20} = \frac{243}{200}$$

$$(36) \quad \frac{7}{3} \div \frac{15}{8} = \frac{7}{3} \times \frac{8}{15} = \frac{112}{45}$$

$$(37) \quad \frac{3}{5} \text{ of } \frac{8}{9} \div \frac{6}{7} \text{ of } \frac{3}{4} = \frac{8}{15} \times \frac{14}{9} = \frac{112}{45}$$

$$(38) \quad \frac{1}{2} \text{ of } \frac{1}{4} \text{ of } \frac{2}{3} \div \frac{1}{8} \text{ of } \frac{4}{9} = \frac{1}{12} \times \frac{18}{1} = 1\frac{1}{2}$$

$$(39) \quad \frac{650}{1} \div \frac{100}{127} = \frac{650}{1} \times \frac{127}{100} = \frac{1651}{2} = 825\frac{1}{2}$$

$$(40) \quad \frac{1273}{1} \div \frac{17}{36} = \frac{1273}{1} \times \frac{36}{17} = 4193\frac{7}{17}$$

$$(41) \quad \frac{4324}{1} \div \frac{128}{475} = \frac{1081}{1} \times \frac{475}{128} = \frac{513475}{32} = 16046\frac{3}{32}$$

(42)

$$6\frac{7}{8} \div 8 = \frac{56}{9 \times 8} = \frac{56}{72} = \frac{7}{9}$$

(43)

$$12\frac{4}{5} \div 42 = \frac{112}{9} \times \frac{1}{42} = \frac{8}{27}$$

(44)

$$3\frac{1}{2} \div 9\frac{1}{2} = \frac{10}{6} \times \frac{2}{10} = \frac{1}{3}$$

(45)

$$100 \div 4\frac{3}{8} = \frac{100}{1} \times \frac{8}{33} = \frac{160}{3} = 22\frac{2}{3}$$

(46)

$$44\frac{1}{2} \div 3\frac{1}{2} = \frac{1453}{33} \times \frac{111}{213} = \frac{161283}{2343} = 68\frac{1252}{2343} = 68\frac{417}{781}$$

(47)

$$111\frac{1}{2} \div 33\frac{1}{2} = \frac{10}{9} \times \frac{3}{100} = \frac{10}{3} = 3\frac{1}{3}$$

(48)

$$191\frac{1}{2} \div 159\frac{1}{2} = \frac{2}{5} \times \frac{3}{478} = \frac{6}{5} = 1\frac{1}{5}$$

(49)

$$5\frac{2}{3} \div \frac{2}{3} \text{ of } 1\frac{1}{2} = \frac{43}{8} \times \frac{86}{9} = 9\frac{8}{9}$$

(50)

$$5205\frac{1}{2} \div \frac{1}{2} \text{ of } 2\frac{1}{2} = \frac{13013}{5} \times \frac{1}{72} = 72\frac{13}{36}$$

(51)

$$3\frac{1}{2} \div \frac{1}{8} = \frac{21}{32} \times \frac{8}{1} = \frac{21}{4} = 5\frac{1}{4} \text{ lb.}$$

(52)

$$7 \div \frac{4}{5} = \frac{7}{8} \times \frac{5}{4} = \frac{35}{32} = 1\frac{3}{32} \text{ yd.}$$

(53)

$$9 \div \frac{3}{8} = \frac{9 \div 3}{16 \div 8} = \frac{3}{2} = 1\frac{1}{2} \text{ bush.}$$

(54)

$$\frac{8}{10} = \frac{1}{5} = \frac{8 \div 1}{10 \div 5} = \frac{8}{5} = 4 \text{ horses}$$

(55)

$$3 \div \frac{6}{7} = \frac{3}{5} \times \frac{7}{6} = 3\frac{7}{10}$$

(56)

$$6 \div 1\frac{5}{8} = 6 \times \frac{8}{13} = \frac{48}{13} = 3\frac{9}{13}$$

(57)

$$2 \div \frac{3}{8} = \frac{2}{3} \times \frac{8}{3} = 1\frac{6}{9} = 1\frac{2}{3}$$

(58)

$$1\frac{5}{7} \div \frac{7}{8} = \frac{12}{7} \times \frac{8}{2} = 6 \text{ gal}$$

(59)

$$\frac{35}{24} \div \frac{7}{9} = \frac{35 \div 7}{24 \div 9} = \frac{5}{8}$$

(60)

$$15\frac{3}{4} \div \frac{3}{4} = \frac{63}{4} \div \frac{3}{4} = 21$$

(61)

$$146 \div 5\frac{1}{8} = \frac{146}{1} \times \frac{8}{41} = 27\frac{2}{11}$$

(62)

$$520\frac{1}{2} \div 36\frac{9}{10} = \frac{289}{5} \times \frac{10}{41} = \frac{578}{41} = 14\frac{4}{41}$$

(63)

$$\frac{3}{8} \div \frac{8}{9} \text{ of } \frac{7}{9} \text{ of } 121 = \frac{3}{8} \times \frac{9}{8} \times \frac{7}{3} \times \frac{8}{121} = \frac{56}{393}$$

(64)

$$4\frac{2}{5} \div 7 = \frac{6}{75} = 8\frac{2}{25}$$

(65)

$$\frac{3}{7} \div 10\frac{1}{2} = \frac{3}{7} \times \frac{2}{21} = \frac{2}{49}$$

(66)

$$3 \div \frac{1}{4} = \frac{3}{1} \times \frac{4}{1} = 12$$

(67)

$$165\frac{3}{5} \div 8\frac{1}{2} = \frac{1485}{5} \times \frac{2}{17} = \frac{2970}{85} = 19\frac{2}{17} \text{ lb.}$$

(68)

$$138\frac{1}{2} \div 9\frac{3}{5} = \frac{111}{2} \times \frac{5}{54} = \frac{222}{18} = 12\frac{2}{3} \text{ bbl.}$$

(69)

$$3\frac{1}{2} \div 8 = \frac{7}{2} \div 8 = \frac{7}{16}$$

(70)

$$7\frac{1}{8} \div 8 = \frac{57}{8} \div 8 = \frac{57}{64}$$

(71)

$$10\frac{1}{2} \div \frac{1}{2} = \frac{21}{2} \times \frac{2}{1} = 21$$

(72)

$$84\frac{7}{8} \div \frac{1}{2} = \frac{193}{8} \times \frac{2}{1} = \frac{193}{4} = 48\frac{1}{4} \text{ bushels.}$$

(73)

$$5\frac{1}{8} \div 6\frac{3}{4} = \frac{51}{8} \times \frac{4}{27} = \frac{51}{54} = \frac{17}{18} \text{ yd.}$$

(74)

$$125\frac{5}{7} \div 31\frac{6}{7} = \frac{880}{7} \div \frac{220}{7} = 4 \text{ da.}$$

(75)

$$31\frac{1}{2} \div 1\frac{1}{2} = \frac{63}{2} \times \frac{2}{3} = 21 \text{ bottles.}$$

(76)

$$15\frac{3}{5} \div 11 = \frac{78}{5} \div 11 = \frac{78}{55} = 1\frac{23}{55} \text{ da.}$$

(77)

$$6 \div \frac{1}{4} = 6 \times 4 = 24$$

(78)

$$81 \div \frac{9}{4} = \frac{81}{1} \times \frac{4}{9} = 36; 36 \div 8 = 4\frac{1}{2} \text{ Ans.}$$

(79)

$$\frac{5}{8} \text{ of } \frac{48}{1} \div \frac{5}{9} = \frac{30}{1} \times \frac{9}{5} = 54; 54 \div 9 = 6 \text{ Ans.}$$

(80)

$$\frac{1}{3} \text{ of } \frac{21}{2} \div \frac{4}{5} = \frac{21}{2} \times \frac{5}{4} = \frac{105}{8} = 13\frac{1}{8}$$

(81)

$$4\frac{1}{2} \div 5\frac{1}{2} = \frac{22}{5} \times \frac{2}{11} = \frac{4}{5}$$

(82)

$$2540 \div \frac{5}{4} \text{ of } \frac{5}{9} = \frac{2540}{1} \times \frac{12}{5} = 6096 \text{ Ans.}$$

(83)

$$9\frac{1}{4} \div \frac{1}{2} \text{ of } \frac{3}{4} = \frac{131}{14} \times \frac{2}{15} = \frac{262}{15} = 17\frac{7}{15} \text{ weeks. Ans.}$$

COMPLEX FRACTIONS.

(1)

$$\frac{5}{4} = \frac{5}{8} \div \frac{1}{2} = \frac{5}{8} \times \frac{2}{1} = \frac{5}{4} = 1\frac{1}{4}$$

(2)

$$\frac{8}{16} = \frac{8}{9} \div \frac{1}{16} = \frac{8}{9} \times \frac{16}{1} = \frac{128}{9}$$

(3)

$$\frac{15}{16} = \frac{14}{9} \div \frac{9}{16} = \frac{14}{9} \times \frac{16}{9} = \frac{224}{81} = 2\frac{62}{81}$$

(4)

$$\frac{87\frac{1}{2}}{\frac{7}{8}} = \frac{175}{2} \times \frac{8}{7} = 100$$

(5)

$$\frac{\frac{8}{9}}{4\frac{1}{2}} = \frac{8}{9} \div \frac{9}{2} = \frac{8}{9} \times \frac{2}{9} = \frac{16}{81}$$

(6)

$$\frac{8\frac{1}{2}}{12} = \frac{17}{2} \div \frac{1}{1} = \frac{17}{2} \times \frac{1}{1} = \frac{17}{2}$$

(7)

$$\frac{11\frac{3}{4}}{8\frac{7}{8}} = \frac{45\frac{3}{4}}{35\frac{7}{8}} \div \frac{7}{8} = \frac{45}{4} = 11\frac{1}{4}$$

(8)

$$\frac{20}{\frac{4}{7}} = 20 \div \frac{4}{7} = \frac{20}{1} \times \frac{7}{4} = 35$$

(9)

$$\frac{\frac{5}{4} \text{ of } 7\frac{3}{11}}{\frac{4}{11} \text{ of } 17\frac{3}{7}} = \frac{\frac{5}{4} \text{ of } \frac{80}{11}}{\frac{4}{11} \text{ of } \frac{122}{7}} = \frac{100}{88} \div \frac{488}{77} = \frac{50}{99} \times \frac{77}{488} = \frac{350}{488}$$

(10)

$$\frac{26\frac{3}{5}}{\frac{3}{5} \text{ of } 17} = \frac{138}{35} \div \frac{3}{5} = \frac{138}{35} \times \frac{5}{3} = \frac{18}{7} = 2\frac{4}{7}$$

(11)

$$\frac{55\frac{1}{2}}{\frac{1}{2} \text{ of } 8\frac{1}{2}} = \frac{111}{2} \div \frac{1}{2} = \frac{111}{2} \times \frac{2}{1} = 111$$

(12)

$$\frac{5}{8} \text{ of } \frac{3}{10} \text{ of } \frac{9\frac{3}{4}}{13} = \frac{5}{8} \text{ of } \frac{3}{10} \text{ of } \frac{39}{4} \div \frac{1}{1} = \frac{5}{8} \text{ of } \frac{3}{10} \text{ of } \frac{39}{4} \times \frac{1}{1} = \frac{9}{8}$$

APPLICATIONS IN FRACTIONS.

(1)

$$\frac{1}{6} \text{ of } \frac{3}{7} \text{ of } \frac{4}{5} \text{ of } \frac{50}{1} \times \frac{21}{4} = \$15$$

(2)

$$6\frac{3}{5} \div \frac{3}{8} = \frac{33}{5} \times \frac{8}{3} = \frac{88}{5} = \$17\frac{3}{5}$$

(3)

$$77\frac{3}{5} \div 10\frac{1}{2} = \frac{387}{5} \div \frac{21}{2} = \frac{129}{5} \times \frac{2}{21} = \frac{258}{35} = 7\frac{3}{5} \text{ miles. Ans.}$$

(4)

$$\frac{3}{5} \times 11\frac{1}{3} = \frac{68}{5}; \quad \frac{68}{5} - \frac{6}{15} = \frac{884}{75} - \frac{162}{75} = \frac{722}{75};$$

$$\frac{722}{75} \times 20\frac{3}{4} = \frac{361}{351} \times \frac{83}{4} = \frac{29963}{702} = 42\frac{419}{702} \text{ Ans.}$$

(5)

$$\frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} = \frac{105}{312} + \frac{63}{312} + \frac{45}{312} + \frac{35}{312} = \frac{248}{312} = \text{sum};$$

$$\frac{3}{4} \text{ of } \frac{248}{312} = \frac{62}{105}; \quad \frac{1}{4} + \frac{1}{8} + \frac{1}{8} = \frac{6}{24} + \frac{4}{24} + \frac{3}{24} = \frac{13}{24};$$

$$\frac{62}{105} - \frac{13}{24} = \frac{1488}{2520} - \frac{1365}{2520} = \frac{123}{2520} = \frac{41}{840} \text{ Ans.}$$

(6)

$$7\frac{1}{2} \div \frac{2}{3} = \frac{19}{8} \times \frac{5}{3} = \$9\frac{5}{8} \text{ cost of one ton};$$

$$\frac{95}{8} \times \frac{20}{9} = \frac{475}{18} = \$26\frac{7}{18} \text{ Ans.}$$

$$(7) \quad \frac{3}{8} \div \frac{7}{8} = \frac{3}{8} \times \frac{8}{7} = \frac{3}{7} \text{ price of 1 yd. ; } \frac{80}{7} \div \frac{16}{7} = \frac{80}{7} \times \frac{7}{16} = 15 \text{ yd.}$$

$$(8) \quad 4\frac{3}{4} \times 3\frac{1}{2} = \frac{14}{3} \times \frac{7}{2} = \frac{49}{3} = 16\frac{1}{3}$$

$$(9) \quad 6\frac{3}{4} \div \frac{1}{2} = \frac{27}{2} \times \frac{2}{1} = \frac{27}{1} = 33\frac{1}{2} \text{ pk.} = 8 \text{ bu. } 1\frac{1}{2} \text{ pk.}$$

$$(10) \quad \begin{array}{rcl} \frac{3}{4} \text{ league} & = & 2 \text{ mi. } 0 \text{ fur. } 0 \text{ rd.} \\ \frac{7}{16} \text{ mile} & = & \frac{5 \text{ " } 24 \text{ "}}{1 \text{ mi. } 2 \text{ fur. } 16 \text{ rd.}} \end{array}$$

$$(11) \quad \begin{array}{rcl} 4\frac{9}{16} \text{ mi.} & = & 4 \text{ mi. } 7 \text{ fur. } 8 \text{ rd.} \\ \frac{3}{4} \text{ fur.} & = & 11 \text{ rd. } 2 \text{ yd. } 1\frac{1}{4} \text{ ft.} \\ \frac{3}{8} \text{ of } 1\frac{1}{2} \text{ yd.} & = & 2\frac{7}{16} \text{ ft.} \end{array}$$

$$4 \text{ mi. } 7 \text{ fur. } 19 \text{ rd. } 3 \text{ yd. } 0\frac{3}{4} \text{ ft.}$$

$$(12) \quad 36\frac{3}{8} \div 1\frac{1}{2} = \frac{183}{8} \div \frac{3}{2} = 20\frac{1}{2} \text{ days.}$$

$$(13) \quad 4\frac{1}{5} \times 5\frac{1}{3} = \$22, \text{ value of cloth ; } 22 \div 1\frac{1}{7} = \frac{154}{7} \div \frac{1}{7} = 14 \text{ da.}$$

$$(14) \quad 100 \div 14\frac{2}{3} = \frac{300}{3} \div \frac{44}{3} = \frac{75}{11} = \text{remainder ; } 27\frac{3}{4} - \frac{75}{11} =$$

$$\frac{111}{4} - \frac{75}{11} = \frac{1221}{44} - \frac{300}{44} = \frac{921}{44} = 20\frac{1}{4} = \text{subtrahend or number.}$$

(15)

$\frac{2}{7}$ of \$6300 = \$2700, A's share ; $\frac{1}{3}$ of \$6300 = \$2800, B's share ;
 $2700 + 2800 = \$5500$; $6300 - 5500 = \$800$, C's share. *Ans.*

(16)

$\frac{3}{4} - \frac{3}{8} = \frac{3}{8}$; $1 - \frac{3}{8} = \frac{5}{8}$; since 1 diminished by $\frac{3}{8}$ of itself leaves $\frac{5}{8}$ of itself, *any number* diminished by $\frac{3}{8}$ of itself will leave $\frac{5}{8}$ of itself ; hence, 34 is $\frac{5}{8}$ of the required number ;

$$34 \div \frac{5}{8} = 40 \text{ } \textit{Ans.}$$

(17)

$\frac{2}{3}$ of £15	= £4	5s.	8d.	$2\frac{2}{3}$ far.
£3 $\frac{2}{3}$	= £3	8s.	6d.	$3\frac{2}{3}$ "
$\frac{1}{2}$ of $\frac{5}{7}$ of $\frac{2}{3}$ of £1 =		2s.	10d.	$1\frac{1}{2}$ "
$\frac{2}{3}$ of $\frac{2}{7}$ of a shilling =			3d.	$1\frac{1}{2}$ "
	<hr/>			
	£7	17s.	5d.	$0\frac{1}{2}$ far. <i>Ans.</i>

(18)

John's marbles are $\frac{6}{8}$ of James' marbles, and all the marbles will be $\frac{14}{8}$ of James' ; of these 14 parts, John must have 6, and James 8 of them ; John has $\frac{6}{14}$ of 56 = 24, and James, $\frac{8}{14}$ of 56 = 32.

(19)

$\frac{2}{7}$ of 2000 = $857\frac{1}{7}$ acres ; $\frac{2}{3}$ of $857\frac{1}{7}$ = $571\frac{2}{7}$ acres sold ;
 $857\frac{1}{7} - 571\frac{2}{7} = 285\frac{5}{7}$ acres retained. *Ans.*

(20)

$\frac{1}{3}$ of 240 = 80, A's ; $\frac{1}{6}$ of 240 = 40, B's ; $\frac{1}{4}$ of 240 = 60, C's ;
 $\frac{1}{8}$ of 240 = 30, D's ; $80 + 40 + 60 + 30 = 210$; $240 - 210 = 30$, the remainder.

(21)

$\frac{1}{3}$ of 3740 = \$1246 $\frac{2}{3}$; $1246\frac{2}{3} + 156\frac{1}{3} = \1403 , whole gain;
 $\$1403 \div 3 = \$467\frac{2}{3}$, annual gain. *Ans.*

(22)

$\frac{2}{3} + \frac{1}{4} = \frac{11}{12} = \$1\frac{1}{6}$, what they gave for it; $1\frac{2}{3} + \frac{1}{12} = \$2\frac{1}{6}$,
 what they sold it for; the first paid 6 parts as often as the
 second paid 7 parts; therefore, the first must have $\frac{6}{12}$ of
 $\frac{11}{12} = \$\frac{11}{20}$; and the second $\frac{7}{12}$ of $\frac{11}{20} = \$\frac{77}{200}$. *Ans.*

(23)

$\frac{3}{4}$ of 126 $\frac{1}{2}$ = 79 $\frac{3}{4}$ bushels; $79\frac{3}{4} \times \$2\frac{1}{2} = \$174\frac{3}{4}$;
 $126\frac{1}{2} - 79\frac{3}{4} = 47\frac{1}{4}$ bushels; $47\frac{1}{4} \times 1\frac{3}{4} = 83\frac{1}{4}$
 $\$257\frac{1}{2}$ *Ans.*

(24)

$1\frac{1}{2} + \frac{1}{2} = \frac{5}{2} = \$2\frac{1}{2}$; $19\frac{1}{2} \div 2\frac{1}{2} = 7\frac{1}{2}$ bushels. *Ans.*

(25)

$\$492\frac{2}{3} = \frac{2}{3}$ of the capital; $\$492\frac{2}{3} \div \frac{2}{3} = \$246\frac{1}{3}$, which is $\frac{1}{3}$
 of the capital; $\$246\frac{1}{3} \times 7 = \$1724\frac{1}{3}$, A's share; $\$246\frac{1}{3} \times$
 5 = \$1231 $\frac{2}{3}$, B's share. *Ans.*

(26)

$63 \div \frac{1}{3} = 72$, what he had in the second field; $\frac{5}{6}$ of 72 = 120 ;
 $120 \div 4 = 30$, what he had in the third field; $63 + 72 +$
 $30 = 165$ sheep. *Ans.*

DUODECIMALS.

ADDITION AND SUBTRACTION.

(1)

$$86' \div 12 = 7 \text{ ft. } 2'$$

(2)

$$750'' \div 12 = 62' 6''; 62' 6'' \div 12 = 5 \text{ ft. } 2' 6''$$

(3)

$$37000''' \div 12 = 3083'' 4''';$$

$$3083'' \div 12 = 256' 11'';$$

$$256' \div 12 = 21 \text{ ft. } 4';$$

$$21 \text{ ft. } 4' 11'' 4''' \text{ Ans.}$$

(4)

$$67' \div 12 = 5 \text{ ft. } 7' \text{ Ans.}$$

(5)

$$470''' \div 12 = 39'' 2''';$$

$$39'' \div 12 = 3' 3'';$$

$$3' 3'' 2''' \text{ Ans.}$$

(6)

$$375'' \div 12 = 31' 3'';$$

$$31' \div 12 = 2 \text{ ft. } 7';$$

$$2 \text{ ft. } 7' 3'' \text{ Ans.}$$

(7)

$$8 \text{ ft. } 9' 7''$$

$$6 \text{ ft. } 7' 3'' 4'''$$

$$15 \text{ ft. } 4' 10'' 4''' \text{ Ans.}$$

(8)

$$32 \text{ ft. } 6' 6'' 0'''$$

$$29 \text{ ft. } 0' 0' 7'''$$

$$3 \text{ ft. } 6' 5'' 5''' \text{ Ans.}$$

(9)

$$9 \text{ ft. } 6' 4'' 3'''$$

$$12 \quad 2 \quad 9 \quad 10$$

$$26 \quad 0 \quad 5$$

$$40 \quad 1 \quad 0 \quad 3$$

$$87 \text{ ft. } 10' 7'' 4''' \text{ Ans.}$$

(10)

$$125 \text{ ft. } 0' 6'' 0'''$$

$$45 \quad 11 \quad 0 \quad 2$$

$$12 \quad 6$$

$$183 \text{ ft. } 5' 6'' 2''' \text{ Ans.}$$

$$\begin{array}{r}
 (11) \\
 84 \text{ ft. } 7' \ 0'' \ 0''' \\
 96 \quad 0 \ 11 \ 0 \\
 42 \quad 6 \ 9 \ 10 \\
 \hline
 \quad 5 \ 7 \ 11 \\
 223 \text{ ft. } 8' \ 4'' \ 9''' \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 (12) \\
 127 \text{ ft. } 3' \ 6'' \ 4''' \ 11'''' \\
 40 \quad 0 \ 10 \ 7 \ 5 \\
 \hline
 87 \text{ ft. } 2' \ 7'' \ 9''' \ 6'''' \text{ A.}
 \end{array}$$

$$\begin{array}{r}
 (13) \\
 425 \text{ ft. } 9' \ 10'' \ 0''' \\
 107 \quad 10 \ 9 \ 8 \\
 \hline
 317 \text{ ft. } 11' \ 0'' \ 4''' \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 (14) \\
 325 \text{ ft. } 7' \ 6'' \ 2''' \\
 217 \quad 10 \ 9 \ 0 \\
 \hline
 543 \text{ ft. } 6' \ 3'' \ 2''' \text{ sum.} \\
 107 \text{ ft. } 8' \ 9'' \ 2''' \text{ diff.}
 \end{array}$$

MULTIPLICATION.

$$\begin{array}{r}
 (1) \\
 12 \text{ ft. } 6' \\
 1 \quad 5 \\
 \hline
 5 \text{ ft. } 2' \ 6'' \\
 12 \quad 6 \\
 \hline
 17 \text{ ft. } 8' \ 6'' \\
 2 \quad 4 \\
 \hline
 5 \text{ ft. } 10' \ 10'' \\
 35 \quad 5 \ 0 \\
 \hline
 41 \text{ cu. ft. } 3' \ 10''
 \end{array}$$

$$\begin{array}{r}
 (2) \\
 9 \text{ ft. } 6' \\
 4 \quad 7 \\
 \hline
 5 \text{ ft. } 6' \ 6'' \\
 38 \quad 0 \\
 \hline
 43 \text{ sq. ft. } 6' \ 6''
 \end{array}$$

$$\begin{array}{r}
 (3) \\
 12 \text{ ft. } 5' \\
 6 \quad 8 \\
 \hline
 8 \text{ ft. } 3' \ 4'' \\
 74 \quad 6 \\
 \hline
 82 \text{ sq. ft. } 9' \ 4''
 \end{array}$$

$$\begin{array}{r}
 (4) \\
 35 \text{ ft. } 4' \ 6'' \\
 9 \quad 10 \\
 \hline
 29 \text{ ft. } 5' \ 9'' \\
 318 \quad 4 \\
 \hline
 347 \text{ sq. ft. } 10' \ 3''
 \end{array}$$

$$\begin{array}{r}
 (5) \\
 45 \text{ ft. } 4' \ 3'' \\
 12 \quad 2 \ 9 \\
 \hline
 2 \text{ ft. } 10' \ 0'' \ 2''' \ 3'''' \\
 7 \quad 6 \ 8 \ 6 \\
 544 \quad 3 \ 0 \\
 \hline
 554 \text{ sq. ft. } 7' \ 8'' \ 8''' \ 3''''
 \end{array}$$

$$\begin{array}{r}
 \text{(6)} \\
 \begin{array}{r}
 140 \text{ ft.} \quad 0' \quad 2'' \quad 4''' \\
 \underline{20 \quad 10} \\
 116 \text{ ft.} \quad 8' \quad 1'' \quad 11''' \quad 4'''' \\
 2800 \quad \quad 3 \quad 10 \quad 8 \\
 \hline
 2917 \text{ sq. ft.} \quad 0' \quad 0'' \quad 7''' \quad 4''''
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(7)} \\
 \begin{array}{r}
 279 \text{ ft.} \quad 10' \quad 6'' \\
 \underline{\quad \quad 8 \quad 4} \\
 7 \text{ ft.} \quad 9' \quad 3'' \quad 6''' \\
 186 \quad \quad 7 \quad 0 \quad 0 \\
 \hline
 194 \text{ sq. ft.} \quad 4' \quad 3'' \quad 6'''
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(8)} \\
 \begin{array}{r}
 14 \text{ ft.} \quad \quad 6' \quad 3'' \\
 \underline{2 \quad \quad 9} \\
 10 \text{ ft.} \quad 10' \quad 8'' \quad 3''' \\
 29 \quad \quad 0 \quad 6 \\
 \hline
 39 \text{ sq. ft.} \quad 11' \quad 2'' \quad 3'''
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(9)} \\
 \begin{array}{r}
 18 \text{ ft.} \quad 9' \\
 \underline{15 \quad \quad 10} \\
 15 \text{ ft.} \quad 7' \quad 6'' \\
 281 \quad \quad 3 \\
 \hline
 296 \text{ sq. ft.} \quad 10' \quad 6''
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(10)} \\
 \begin{array}{r}
 70 \text{ ft.} \quad 9' \\
 \underline{12 \quad \quad 3} \\
 17 \text{ ft.} \quad 8' \quad 3'' \\
 849 \quad \quad 0 \\
 \hline
 9)866 \text{ sq. ft.} \quad 8' \quad 3'' \\
 \hline
 96 \text{ sq. yd.} \quad 2 \text{ sq. ft.} \quad 8' \quad 3''
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(11)} \\
 \begin{array}{r}
 75 \\
 \underline{42} \\
 3150 \text{ sq. ft.}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(12)} \\
 \begin{array}{r}
 118 \\
 \underline{25} \\
 9)2950 \text{ sq. ft.} \\
 327\frac{1}{2} \text{ sq. yd.}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(13)} \\
 \begin{array}{r}
 18 \text{ ft.} \quad 0' \\
 14 \text{ in} = 1 \text{ ft.} \quad 2' \\
 \hline
 3 \text{ ft.} \quad 0' \\
 \underline{18} \\
 21 \text{ sq. ft.}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(14)} \\
 27 \times 22 = 594 \text{ sq. ft.} = 66 \text{ sq. yd.} = \text{square measure of the side;} \\
 .40 \times 66 = \$26.40 \text{ Ans}
 \end{array}$$

(15)

$$45 \times 37 = 1665 \text{ sq. rd.} = 10 \text{ A. } 1 \text{ R. } 25 \text{ P. } \textit{Ans.}$$

(16)

$$\begin{array}{r} 112 \text{ ft. } 5' \\ 27 \quad 9 \\ \hline 84 \text{ ft. } 3' 9'' \end{array} \quad \begin{array}{l} 4 \text{ ft. } 6' \times 4 \text{ ft.} = 18 \text{ sq. ft.} = \text{sq. meas. of stone,} \\ 6 \text{ ft. } 9' \times 264 = 1782 \text{ sq. ft.} = \text{sq. meas. of walk,} \\ 1782 \div 18 = 99 \text{ stones. } \textit{Ans.} \end{array}$$

$$\begin{array}{r} 3035 \quad 3 \\ \hline \end{array}$$

$$3119 \text{ sq. ft. } 6' 9''$$

(18)

$$\begin{array}{r} 64 \text{ ft. } 6' \\ 64 \quad 6 \\ \hline 32 \text{ ft. } 3' 0'' \\ 4128 \\ \hline 4160 \text{ sq. ft. } 3' 0'' \\ 4160 \text{ sq. ft. } 3' = 4160 \frac{1}{4} \text{ sq. ft. ;} \\ 4160 \frac{1}{4} \times .05 = \$208.01 \frac{1}{4} \end{array}$$

(19)

$$\begin{array}{r} 6 \text{ ft. } 9' \\ 4 \quad 8 \\ \hline 4 \text{ ft. } 6' \\ 27 \quad 0 \\ \hline 31 \text{ ft. } 6' \\ 2 \quad 10 \\ \hline 26 \text{ ft. } 3' \\ 63 \quad 0 \\ \hline 89 \text{ cu. ft. } 3' \end{array}$$

(20)

$$\begin{array}{r} 97 \text{ ft. } 4' \\ 9 \quad 6 \\ \hline 876 \text{ ft. } 0' \\ 48 \quad 8 \\ \hline 924 \text{ sq. ft. } 8' \\ 924 \frac{2}{3} \text{ sq. ft. } \div 9 = 102 \frac{2}{3} \text{ sq. yd. ;} \\ 102 \frac{2}{3} \times .18 = \$18.49 \frac{1}{3} \textit{ Ans.} \end{array}$$

(21)

$$\begin{array}{l} 18 \times 7 \times 4 = 504 \text{ cu. ft.} \\ 504 \div 128 = 3 \frac{3}{8} \text{ cords.} \end{array}$$

(22)

$$\begin{array}{l} 48 \times 9 \times 3 \frac{1}{2} = 1512 \text{ cu. ft.} \\ 1512 \div 128 = 11 \frac{3}{8} \text{ cords.} \end{array}$$

(23)

$$\begin{array}{l} 21 \frac{1}{2} \times 15 \times 10 = 3225 \text{ cu. ft.} = 5572800 \text{ cu. in. ;} \\ 5572800 \div 231 = 24124 \frac{2}{7} \text{ gal.} \end{array}$$

(24)

12 ft. 4'

8

98 sq. ft. 8'

15 " 9'

1554 cu. ft.

 $8 \times 4 \times 2 = 64$ cu. in. = contents of a brick ; $1554 \times 1728 = 2685412$ cu. in., in pile ; $2685412 \div 64 = 41958$ bricks. *Ans.*

(25)

The long side of the ditch = 240 ft. + 7 ft. = 247 ft., and
 the short side = 164 ft.; the whole length of the ditch is
 $247 \times 2 + 164 \times 2 = 822$ ft.; $822 \times 3\frac{1}{2} \times 6\frac{1}{2} = 19419\frac{3}{4}$
 cubic feet.

(26)

36 ft. 5'

6 8

24 ft. 3' 4"

218 6

242 ft. 9' 4"

3 6

121 ft. 4' 8"

728 4 0

849 cu. ft. 8' 8"

(27)

26 ft. 8'

6 6

13 ft. 4'

160 0

173 ft. 4'

3 8

43 ft. 4'

520 0

563 cu. ft. 4'

 $563 \div 128 = 4$ C. 51 cu. ft.

51 ft. 4' = 616'

1 C. = 128 c. ft. = 1536'

51 ft. 4' = $\frac{616}{1536} = \frac{77}{192}$ C. $4\frac{77}{192} \times 3.50 = 15.40\frac{35}{96}$

(28)

38 ft. 10'

20 6

19 ft. 5'

776 8

796 ft. 1'

9 4

265 ft. 4' 4"

7164 9

7430 cu. ft. 1' 4"

 $7430 \div 27 = 275$ cu. yd. 5 cu. ft.

5 cu. ft. 1' 4" = 736"

1 cu. yd. 27 cu. ft. = 3888"

5 cu. ft. 1' 4" = $\frac{736}{3888} = \frac{46}{243}$ cu. yd. 7430 cu. ft. 1' 4" = $275\frac{46}{243}$ cu. yd

(29)

22 ft.	8'	22 ft.	8'
22	8	18	9
18	9		
18	9	425 sq. ft.	0' ceiling.
82 ft.	10'	139 sq. ft.	4' windows
11	6	47	6 doors.
911 ft.	2'	76	6 base.
41	5	263 sq. ft.	4'
952 sq. ft.	7' sides of the room.		
425	0 ceiling of the room.		
1377 sq. ft.	7'		
263	4		
9) 1114 sq. ft.	3'		
123 $\frac{2}{3}$ sq. yd.			

$$123\frac{2}{3} \times 16 = \$19.80\frac{2}{3} \text{ Ans.}$$

DIVISION.

(1)

6 ft. 4')	29 sq. ft.	0'	4''	(4 ft. 7' Ans.
25		4		
3 sq. ft.	8'	4''		
8	8	4		

(2)

9 ft. 6')	50 ft.	0'	10''	6'''	(5 ft. 3' 3'' Ans.
47	6				
2	6'	10''			
2	4	6			
2'	4''	6'''			
2	4	6			

(3)

$$\begin{array}{r}
 24 \text{ ft. } 3') 1176 \text{ sq. ft. } 1' \ 6'' (48 \text{ ft. } 6' \text{ Ans.} \\
 \underline{1164} \qquad \qquad \qquad 0 \\
 12 \qquad \qquad \qquad 1' \ 6'' \\
 \underline{12} \qquad \qquad \qquad 1 \ 6
 \end{array}$$

(4)

$$\begin{array}{r}
 3 \text{ ft. } 4') 119 \text{ cu. ft. } 2' \ 6'' \ 8''' (35 \text{ sq. ft. } 9' \ 2'' \\
 \underline{116} \qquad \qquad \qquad 8' \\
 2 \qquad \qquad \qquad 6' \ 6'' \\
 \underline{2} \qquad \qquad \qquad 6 \ 0 \\
 \qquad \qquad \qquad \qquad \qquad 6'' \ 8''' \\
 \qquad \qquad \qquad \qquad \qquad \underline{6 \ 8}
 \end{array}$$

$$\begin{array}{r}
 4 \text{ ft. } 2') 35 \text{ sq. ft. } 9' \ 2'' (8 \text{ ft. } 7' \text{ Ans.} \\
 \underline{33} \qquad \qquad \qquad 4' \\
 2 \qquad \qquad \qquad 5' \ 2'' \\
 \underline{2} \qquad \qquad \qquad 5 \ 2
 \end{array}$$

(5)

$$\begin{array}{r}
 3 \text{ ft. } 9') 105 \text{ cu. ft. } 5' \ 7'' \ 6''' (28 \text{ ft. } 1' \ 6'' \\
 \underline{105} \qquad \qquad \qquad 0' \\
 \qquad \qquad \qquad 5' \ 7'' \\
 \qquad \qquad \qquad \underline{3 \ 9} \\
 \qquad \qquad \qquad 1' \ 10'' \ 6''' \\
 \qquad \qquad \qquad \underline{1 \ 10 \ 6}
 \end{array}$$

$$\begin{array}{r}
 2 \text{ ft. } 3') 28 \text{ sq. ft. } 1' \ 6'' (12 \text{ ft. } 6' \text{ Ans.} \\
 \underline{27} \qquad \qquad \qquad 0' \\
 1 \qquad \qquad \qquad 1' \ 6'' \\
 \underline{1} \qquad \qquad \qquad 1 \ 6
 \end{array}$$

(6)

$$\begin{array}{r}
 10 \text{ ft. } 7' 394 \text{ sq. ft. } 2' \quad 9'' (37 \text{ ft. } 3' \text{ Ans.} \\
 \underline{391} \quad \quad \quad 7' \\
 \begin{array}{r}
 2 \quad \quad 7' \quad 9'' \\
 2 \quad \quad 7 \quad 9
 \end{array}
 \end{array}$$

(7)

$$\begin{array}{r}
 17 \text{ ft. } 6' 27 \text{ sq. ft. } 8' \quad 6'' (1 \text{ ft. } 7' \text{ Ans.} \\
 \underline{17} \quad \quad \quad 6' \\
 \begin{array}{r}
 10 \quad \quad 2' \quad 6'' \\
 10 \quad \quad 2 \quad 6
 \end{array}
 \end{array}$$

(8)

$$\begin{array}{r}
 158 \text{ cu. yd. } 17 \text{ cu. ft. } 4' \\
 \underline{27} \\
 42 \text{ ft. } 10' 4283 \text{ cu. ft. } 4' (100 \text{ sq. ft.} \\
 \underline{4283} \quad \quad \quad 4 \\
 \begin{array}{r}
 12 \text{ ft. } 6' 100 \text{ ft. } 0' (8 \text{ ft. } \text{Ans.} \\
 \underline{100} \quad \quad \quad 0
 \end{array}
 \end{array}$$

(9)

$$\begin{array}{r}
 4 \text{ ft. } 8' \\
 \underline{2 \quad 10} \\
 3 \quad 10' \quad 8'' \\
 \underline{9 \quad 4}
 \end{array}$$

13 sq. ft. 2' 8'' = product of two dimensions.

$$\begin{array}{r}
 13 \text{ sq. ft. } 2' 8'' 86 \text{ cu. ft. } 2' \quad 7'' \quad 9''' \quad 6'''' (6 \text{ ft. } 6' 3 \frac{1}{15232}'' \\
 \underline{79} \quad \quad \quad 4 \quad 0 \\
 \begin{array}{r}
 6 \quad \quad 10' \quad 7'' \quad 9''' \\
 6 \quad \quad 7 \quad 4 \quad 0 \\
 \hline
 3' \quad 3'' \quad 9''' \quad 6'''' \\
 3 \quad 3 \quad 8 \quad 0 \\
 \hline
 1''' \quad 6''''
 \end{array}
 \end{array}$$

$$\begin{array}{l}
 1''' \quad 6'''' = 18'''' \\
 13 \text{ sq. ft. } 2'' \quad 8'' = 274176'''' \\
 1''' \quad 6'''' \div 13 \text{ sq. ft. } 2' \quad 8'' = 274176 = 15232
 \end{array}$$

DECIMAL FRACTIONS.

(1)
.06 *Ans.*(2)
1.7 *Ans.*(3)
.005 *Ans.*(4)
.27 *Ans.*(5)
.047 *Ans.*(6)
6.41 *Ans.*(7)
7.008 *Ans.*(8)
9.05 *Ans.*(9)
11.50 *Ans.*(10)
44.7 *Ans.*(1)
27.4 *Ans.*(2)
36.015 *Ans.*(3)
99.0027 *Ans.*(4)
.320 *Ans.*(5)
200.000320 *Ans.*(6)
.3600 *Ans.*(7)
5.000003 *Ans.*(8)
40.0000009 *Ans.*(9)
.4900 *Ans.*(10)
59.0067 *Ans.*(11)
.0469(12)
79.000415 *Ans.*(13)
67.0227 *Ans.*(14)
105.0000095 *Ans.*(15)
40.204000 *Ans.*(1)
\$37.265 *A.*(2)
\$17.005 *A.*(3)
\$215.08 *A.*(4)
\$275.005 *A.*(5)
\$9.008 *A.*(6)
\$15.069 *A.*(7)
\$27.182 *A.*(8)
\$3.059 *A.*

ADDITION.

(1)	(2)	(3)
6.035	465.103113	57.406
763.196	.78012	97.004
445.3741	1.34976	4.6
91.5754	.3549	.06
<u>1306.1805</u> <i>Ans.</i>	<u>61.11</u>	<u>.3</u>
	528.697893 <i>Ans.</i>	159.370 <i>Ans.</i>

(4)	(5)	(6)	(7)
.0009	.0049	5.714	3.754
1.0436	49.0426	3.456	47.5
.4	37.0410	.543	.00857
.05	360.0039	<u>17.4957</u>	<u>37.5</u>
<u>.047</u>	<u>446.0924</u>	27.2087	88.76257
1.5415			

(8)	(9)	(10)
54.34	71.25	375.94
.375	1.749	5.732
14.795	1759.5	14.375
<u>1.5</u>	<u>3.1</u>	<u>1.5</u>
71.010	1835.599	397.547

(11)	(12)	(13)
.005	90.00	2.025
.0057	.19	5.0027
31.008	.018	47.000126
<u>.00594</u>	<u>.00211</u>	<u>150.0000017</u>
31.02464	<u>.000019</u>	204.0278277
	90.210129	

(14)
 .327
 .0056
 400.000084
.00001560
 400.33269960

(15)
 .05
 .027
 .00476
 .0190
.0001279
 .1008879

(16)
 25.126
 9.08
 12.74
 18.508
20.009
 \$85.463

(17)
 126.90
 420.756
 317.061
 200.473

 \$1065.190

(18.)
 1.025
 .997
 .88
.9876
 3.8896

(19)
 225.50
 127.055
 75.28

 \$427.835

(20)
 9.375
 2.125
 1.625
6.09
 \$19.215

(21)
 296.75
 126.125
 97.375
 100.10
 50.625

 \$670.975

(22)
 16.408
 4.875
 6.00
 2.378
.625
 \$30.286

(23)
 99.875
 87.078
 59.44
 60.506
21.303
 \$328.202

(24)
 97.004
 25.019
 65.956
 4.878
55.154
 \$248.011

(25)
 37.874
 50.009
 19.046
27.705
 \$134.634

SUBTRACTION.

(1)
 875.0500
.0467
 875.0033

(2)
 410.0591
41.496
 368.5631

(3)
 7141.60400
.09046
 7141.51354

(4)
 57.490
5.768
 51.722

(5)
 3.0750
.3054
 2.7696

(6)
 1745.30
173.45
 1571.85

(7)
 .7000
.0054
 .6946

$$\begin{array}{r}
 (8) \\
 1.00075 \\
 \underline{.105} \\
 .89575 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 (9) \\
 754.355 \\
 \underline{150.43} \\
 603.925 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 (10) \\
 1754.754 \\
 \underline{375.49478} \\
 1379.25922 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 (11) \\
 175.01 \\
 \underline{75.304} \\
 99.706
 \end{array}$$

$$\begin{array}{r}
 (12) \\
 35.49 \\
 \underline{17.541} \\
 17.949
 \end{array}$$

$$\begin{array}{r}
 (13) \\
 .7 \\
 \underline{.000007} \\
 .699993
 \end{array}$$

$$\begin{array}{r}
 (14) \\
 396. \\
 \underline{67.0008} \\
 328.9992
 \end{array}$$

$$\begin{array}{r}
 (15) \\
 1. \\
 \underline{.001} \\
 .999
 \end{array}$$

$$\begin{array}{r}
 (16) \\
 6374. \\
 \underline{59.1} \\
 6314.9
 \end{array}$$

$$\begin{array}{r}
 (17) \\
 365.0075 \\
 \underline{.000005} \\
 365.007495
 \end{array}$$

$$\begin{array}{r}
 (18) \\
 21.004 \\
 \underline{.0098} \\
 20.9942
 \end{array}$$

$$\begin{array}{r}
 (19) \\
 260.3609 \\
 \underline{.0000047} \\
 260.3608953
 \end{array}$$

$$\begin{array}{r}
 (20) \\
 10.0302 \\
 \underline{.000019} \\
 10.030181
 \end{array}$$

$$\begin{array}{r}
 (21) \\
 2.03 \\
 \underline{.0006} \\
 2.0294
 \end{array}$$

$$\begin{array}{r}
 (22) \\
 1000. \\
 \underline{.001} \\
 999.999
 \end{array}$$

$$\begin{array}{r}
 (23) \\
 2500. \\
 \underline{.25} \\
 2499.75
 \end{array}$$

$$\begin{array}{r}
 (24) \\
 200.027 \\
 \underline{97.0120} \\
 103.0150
 \end{array}$$

$$\begin{array}{r}
 (25) \\
 1. \\
 \underline{.5768} \\
 .4232
 \end{array}$$

$$\begin{array}{r}
 (26) \\
 \hline
 \begin{array}{r}
 127.25 \\
 84.125 \\
 \underline{116.7} \\
 328.075
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 500. \\
 \underline{328.075} \\
 171.925 \text{ acres.}
 \end{array}$$

$$\begin{array}{r}
 (27) \\
 700. \\
 \underline{617.375} \\
 82.625
 \end{array}$$

(28)

$$\begin{array}{r}
 \overbrace{\begin{array}{rr} 325.50 & 510.10 \\ 97.125 & 483.50 \\ 60.875 & \underline{\$26.60} \end{array}} \\
 \$183.500
 \end{array}$$

(29)

$$\begin{array}{r}
 \overbrace{\begin{array}{rr} 1.05 & 225.025 \\ 20.007 & 98.18306 \\ 40.1255 & 126.84194 \\ 37.00056 & \underline{} \end{array}} \\
 98.18306
 \end{array}$$

(30)

$$\begin{array}{r}
 1240.06 \\
 1867.985 \\
 \hline
 3108.045 \\
 2346.865 \\
 \hline
 \$761.18
 \end{array}$$

MULTIPLICATION.

(1)

$$\begin{array}{r}
 2.125 \\
 .375 \\
 \hline
 10625 \\
 14875 \\
 \hline
 6375 \\
 \hline
 .796875
 \end{array}$$

(2)

$$\begin{array}{r}
 .4712 \\
 5.6 \\
 \hline
 28272 \\
 23560 \\
 \hline
 2.63872
 \end{array}$$

(3)

$$\begin{array}{r}
 .0125 \\
 .004 \\
 \hline
 .0000500
 \end{array}$$

(4)

$$6.002 \times .25 = 1.50050$$

(5)

$$473.54 \times .057 = 26.99178$$

(6)

$$137.549 \times 75.437 = 10376.283913$$

(7)

$$3 \times .7495 \times 73487 = 165235.5195$$

(8)

$$.04875 \times .47134 = .0206211250$$

(9)

$$.371343 \times 75493 = 28033.797099$$

(10)

$$49.0754 \times 3.5714 = 175.26788356$$

(11)

$$.573005 \times .000754 = .000432045770$$

(12)

$$.375494 \times 577.75 = 216.94165850$$

(13)

$$000294 \times .000001 = .000000000294$$

(14)

$$300.27 \times 62 = 18616.74$$

(15)

$$93.01401 \times 10.03962 = 933.8253150762$$

(16)

$$596.04 \times .000012 = .00715248$$

(17)

$$38049.079 \times .000016 = .608785264$$

(18)

$$1192.08 \times .000024 = .02860992$$

(19)

$$76098.158 \times .000032 = 2.435141056$$

(20)

$$36000 \times .036 = 1296$$

(21)

$$125000 \times .0025 = 312.5$$

(22)

$$50000 \times .0000075 = .375$$

(23)

$$.48 \times .0075 = .0036$$

F*

(24)

$$16.25 \times 9.125 = 148.28125 \text{ sq. rd.}$$

(25)

$$12.07 \times 1.005 = 12.13035 \text{ sq. ft.}$$

(26)

$$.875 \times 27.5 = \$24.0625$$

(27)

$$25.125 \times 127.045 = \$3192.005625$$

(28)

$$11.75 \times 17875 = \$210.03125$$

(29)

$$35.08 \times 420.25 = \$14742.37, \text{ cost of farm ;}$$

$$37.50 \times 196.175 = \$7356.5625 \quad \left. \vphantom{\begin{array}{l} 37.50 \times 196.175 \\ 36.128 \times 224.075 \end{array}} \right\}$$

$$36.128 \times 224.075 = \$8094.709375 \quad \left. \vphantom{\begin{array}{l} 37.50 \times 196.175 \\ 36.128 \times 224.075 \end{array}} \right\}$$

$$\$15451.271875, \text{ price when sold.}$$

$$15451.271875 - 14742.37 = \$708.901875, \text{ gain. Ans.}$$

$$\begin{array}{r} 37.5 \\ 27.35 \\ \hline \end{array}$$

(30)

$$64.85 \times 2.94 = \$190.6590 = \text{price obtained at sale ;}$$

$$37.5 \times 2.75 = \$103.125 \quad \left. \vphantom{\begin{array}{l} 37.5 \times 2.75 \\ 27.35 \times 3.125 \end{array}} \right\}$$

$$27.35 \times 3.125 = \$85.46875 \quad \left. \vphantom{\begin{array}{l} 37.5 \times 2.75 \\ 27.35 \times 3.125 \end{array}} \right\}$$

$$\$188.59375$$

$$190.6590$$

$$188.59375 = \text{cost ;}$$

$$\$2.06525 = \text{gain. A.}$$

CONTRACTIONS IN MULTIPLICATION.

(1)

$$479.64 \times 10 = 4796.4 ; 479.64 \times 100 = 47964 \text{ Ans.}$$

(2)

$$69.4729 \times 1000 = 69472.9 ; 69.4729 \times 10 = 694.729 \text{ Ans.}$$

(3)

$$41.53 \times 10000 = 415300; 41.53 \times 100 = 4153 \text{ Ans.}$$

(4)

$$27.04 \times 100 = 2704; 27.04 \times 1000 = 27040 \text{ Ans.}$$

(5)

$$129.072 \times 1000 = 129072; 129.072 \times 10 = 1290.72 \text{ Ans.}$$

(6)

$$87.1 \times 10000 = 871000; 87.1 \times 100 = 8710 \text{ Ans.}$$

(7)

$$140.1 \times 1000 = 140100; 140.1 \times 10 = 1401 \text{ Ans.}$$

(2)

$$\begin{array}{r} 54.74943 \ 67 \\ \underline{4.714753} \end{array}$$

$$\begin{array}{r} 21899775 \\ 3832461 \\ 54749 \\ 21900 \\ 3832 \\ 274 \\ \underline{16} \end{array}$$

$$258.13007 \text{ Ans.}$$

(3)

$$\begin{array}{r} 475.710 \ 564 \\ \underline{0.3416494} \end{array}$$

$$\begin{array}{r} 142713 \\ 19028 \\ 476 \\ 285 \\ 19 \\ \underline{4} \end{array}$$

$$162.525 \text{ Ans.}$$

(4)

$$\begin{array}{r} 3754.4078 \\ \underline{.734576} \end{array}$$

$$\begin{array}{r} 262808546 \\ 11263223 \\ 1501763 \\ 187720 \\ 26280 \\ \underline{2253} \end{array}$$

$$2757.89785 \text{ Ans.}$$

(5)

$$\begin{array}{r} 4745.679 \\ \underline{751.4549} \end{array}$$

$$\begin{array}{r} 4746 \\ 237284 \\ 3321975 \\ 1898 \\ 237 \\ 19 \\ \underline{4} \end{array}$$

$$3566163 \text{ Ans.}$$

DIVISION.

$$\begin{array}{r} \text{(1)} \\ 2.11 \overline{) 4.6842} \end{array} \begin{array}{l} (2.22 \text{ Ans.}) \\ 4 \ 22 \cdot \cdot \end{array}$$

$$\begin{array}{r} 464 \\ 422 \\ \hline 422 \\ 422 \\ \hline \end{array}$$

$$\text{(3)} \quad 33.66431 \div 1.01 = 33.331$$

$$\begin{array}{r} \text{(2)} \\ 1.505 \overline{) 12.82561} \end{array} \begin{array}{l} (8.522 \text{ Ans.}) \\ 12 \ 040 \cdot \cdot \end{array}$$

$$\begin{array}{r} 7856 \\ 7525 \\ \hline 3311 \\ 3010 \\ \hline \end{array}$$

$$\text{(4)} \quad .010001 \div .01 = 1.0001$$

$$\begin{array}{r} 3010 \\ 3010 \\ \hline \end{array}$$

$$\text{(5)} \quad 24.8410 \div .002 = 12420.5 \text{ Ans.}$$

$$\text{(6)} \quad .0125 \div 2.5 = .005 \text{ Ans.}$$

$$\text{(7)} \quad .051 \div .012 = 4.25 \text{ Ans.}$$

$$\text{(8)} \quad .063 \div 9 = .007 \text{ Ans.}$$

$$\text{(9)} \quad 1.05 \div 14 = .075 \text{ Ans.}$$

$$\text{(10)} \quad 5.1435 \div 4.05 = 1.27. \text{ Ans.}$$

$$\text{(11)} \quad .46575 \div 31.05 = .015 \text{ Ans.}$$

$$\text{(12)} \quad 2.46616 \div .145 = 17.008 \text{ Ans.}$$

$$\begin{array}{r} \text{(13)} \\ 75.15204 \div 3 = 25.05068 \\ \div .3 = 250.5068 \\ \div .03 = 2505.068 \\ \div .003 = 25050.68 \\ \div .0003 = 250506.8 \end{array}$$

$$\begin{array}{r} \text{(14)} \\ 389.27688 \div 8 = 48.65961 \\ \div .08 = 4865.961 \\ \div .008 = 48659.61 \\ \div .0008 = 486596.1 \\ \div .00008 = 4865961 \end{array}$$

(15)	(16)
874.598 + 9 = 41.622	1528.4086488 + 6 = 254.7347748
+ .9 = 416.22	+ .06 = 25473.47748
+ .09 = 4162.2	+ .006 = 254734.7748
+ .009 = 41622	+ .0006 = 2547347.748
+ .0009 = 416220	+ .00006 = 25473477.48
+ .00009 = 4162200	+ .000006 = 254734774.8

(17)	(18)
125.7)17.543275(.1395646 + A.	.7493)1437.5435(1918.515 +

(19)	(20)
.0374).000177089(.004735 A.	9.60)1674.35520(174.412 A.

(21)	(22)
1728)120463.2000(69.7125 A.	34.75)47.54936(1.36832 + A.

(23)	(24)
.00573)74.35716(12976.816 +	75.714).37545987(.004958 +

(25)	(26)
154.125 ÷ 25 = 6.165 cu. yd. A.	\$167.875 ÷ 17 = \$9.875 A.

(27)	(28)
\$97.223 ÷ 45.22 = \$2.15 A.	\$232.655 ÷ 375.25 = \$0.62 A

(29)	(30)
\$2.25 ÷ .125 = 18 lb. Ans.	34 ÷ 4.25 = 8 suits. Ans

(31)
 $366.52 \div 26.18 = 14 \text{ days. Ans.}$

(32)
 $\$2.225 + \$0.985 + \$1.168 = \$4.378 ;$
 $242.979 \div 4.378 = 55.5 \text{ bushels. Ans.}$

(33)

 $46.347 \times 56 = \$2595.432$, cost of wood-land ; $59.465 \times 176 = \$10465.840$, cost of meadow-land ; $13.836 \times 37 = \$511.932$, cost of swamp-land ;Area = 269 $\$13573.204$, entire cost ; $13573.204 \div 269 = \$50.458 +$ average price per acre.

(34)

$4379.837 \times 6 = \$26279.022$; $8345 + 26279.022 = \$34624.022$,
 value of whole property ; $\$3976.48 + 120 = \4096.48 , amount
 of debts ; $34624.022 - 4096.48 = \$30527.542$; $30527.542 \div$
 $4 = \$7631.8855$, the eldest son's share ; $30527.542 -$
 $7631.8855 = \$22895.6565$; $\$22895.6565 \div 4 = \5723.914125 ,
 each of the other sons' shares.

(2)

 $.100001)1097.010970(10970$

(3)

 $.1629735)9811.0047600(60200$

(4)

 $.0001).1000(1000 \text{ Ans.}$

(5)

 $.1)10.0(100 \text{ Ans.}$

(6)

$.6)6.0(10$; $.06)6.00(100$; $.006)6.000(1000$; $.2)6.0(30$;
 $.3)6.0(20$; $.003)6.000(2000$; $.5)6.0(12$; $.005)6.000(1200$;
 $.000012)6.000000(500000$

(3)

 $4.5)37.4000(8.311 + \text{ Ans.}$

(4)

 $375)586.400(1.563 + \text{ Ans.}$

(5)

 $81.032)94.0369000(1.16049 + \text{ Ans.}$

(6)

 $2.25)36.26780(16.11902 + \text{ Ans.}$

CONTRACTIONS IN DIVISION.

(1)

$$\begin{aligned} 3169.274 \div 100 &= 31.69274 \\ \div 1000 &= 3.169274 \end{aligned}$$

(2)

$$\begin{aligned} 57135.62 \div 1000 &= 57.13562 \\ \div 100 &= 571.3562 \\ \div 10 &= 5713.562 \end{aligned}$$

(3)

$$\begin{aligned} 67.5 \div 100 &= .675 \\ \div 1000 &= .0675 \\ \div 1000000 &= .0000675 \end{aligned}$$

(4)

$$\begin{aligned} 4.9 \div 100 &= .049 \\ \div 1000 &= .0049 \\ \div 10000 &= .00049 \end{aligned}$$

(5)

$$\begin{aligned} .30467 \div 10 &= .030467 \\ \div 100 &= .0030467 \\ \div 1000 &= .00030467 \end{aligned}$$

(6)

$$\begin{aligned} .4741 \div 100 &= .004741 \\ \div 1000 &= .0004741 \\ \div 10000 &= .00004741 \end{aligned}$$

(7)

$$\begin{aligned} 4.97 \div 10 &= .497 \\ \div 100 &= .0497 \\ \div 1000 &= .00497 \end{aligned}$$

(1)

$$.74571345) 59.000000 (79.1188 \text{ A.}$$

52 19994

680006

671142

8864

7457

1407

746

661

596

65

59

6

(2)

$$495.783269) 17493.407704962 (35.2843$$

14873 50

261990

247892

14098

9916

4182

3966

216

198

18

15

3

(3)

8.47656180)98.1874370(11.5834036

84 7656180

134218190

84765618

49452572

42382809

7069763

6781249

288514

254297

34217

33906

311

254

57

51

6

(4)

14.734950)47194.379457(3202.8870

44204.850

2989529

2946990

42539

29470

13069

11788

1281

1178

103

103

REDUCTION.

(1)

$$\begin{array}{l} 1 = .25; \quad 1 = .5; \quad 3 = .75. \quad 4 = .8; \quad 7 = .875; \quad 5 = .3125. \\ \hline 4)1.00 \quad 2)1.0 \quad 4)3.00 \quad 5)4.0 \quad 8)7.000 \quad 16)5.0000 \\ \hline .25 \quad .5 \quad .75 \quad .8 \quad .875 \quad .3125 \end{array}$$

(2)

(3)

$$\begin{array}{l} 3 = .375; \quad 1 = .04. \\ \hline 8)3.000 \quad 25)1.00 \\ \hline .375 \quad .04 \end{array}$$

(4)

$$\begin{array}{l} 3 = .015625; \quad 4 = .26666\frac{2}{3} + \\ \hline 192)3.000000 \quad 15)4.00000 \\ \hline .015625 \quad .26666\frac{2}{3} + \end{array}$$

(5)

$$\begin{array}{l} 1 = .125; \quad 3 = .003. \\ \hline 8)1.000 \quad 1000)3.000 \\ \hline .125 \quad .003 \end{array}$$

(6)

$$\begin{array}{l} 9 = .25714 +; \quad 15 = .44117 + \\ \hline 35)9.00000 \quad 34)15.00000 \\ \hline .25714 + \quad .44117 + \end{array}$$

(7)

$$\begin{array}{r} 1412 \\ 5907 \overline{)1412.00000} \\ \hline .23903+ \end{array}$$

(8)

$$\begin{array}{r} 275 \\ 3942 \overline{)275.00000} \\ \hline .07157+ \end{array}$$

(9)

$$\begin{array}{r} 7 \\ 16 \overline{)7.0000} \\ \hline .4375 \end{array} ; \begin{array}{r} 5 \\ 64 \overline{)5.000000} \\ \hline .078125 \end{array}$$

(10)

$$\begin{array}{r} 14 \\ 3125 \overline{)14.00000} \\ \hline .00448 \end{array}$$

(11)

$$\begin{array}{r} 67 \\ 125 \overline{)67.000} \\ \hline .536 \end{array} ; \begin{array}{r} 93 \\ 250 \overline{)93.000} \\ \hline .372 \end{array}$$

(12)

$$\frac{3}{8} \text{ of } \frac{2}{5} \text{ of } \frac{6}{1} = \frac{9}{10} = .9$$

(13)

$$\frac{4}{5} \text{ of } \frac{11}{12} = \frac{11}{15} = .7333\frac{1}{3}$$

$$\begin{array}{r} 11 \\ 15 \overline{)11.0000} \\ \hline .7333\frac{1}{3} \end{array}$$

(14)

$$\frac{9}{16} \text{ of } \frac{43}{50} = \frac{387}{400} = .9675$$

$$\begin{array}{r} 387 \\ 400 \overline{)387.00000} \\ \hline .9675 \end{array}$$

(15)

$$\frac{2}{3} \text{ of } \frac{2\frac{1}{2}}{3\frac{1}{4}} = \frac{20}{39} = .51282+$$

$$\begin{array}{r} 20 \\ 39 \overline{)20.00000} \\ \hline .51282+ \end{array}$$

(16)

$$\frac{10\frac{1}{2}}{20} = \frac{43}{80} = .5375 ; \frac{4\frac{1}{2}}{758} = \frac{17}{3032} = .005606+$$

$$\begin{array}{r} 43 \\ 80 \overline{)43.0000} \\ \hline .5375 \end{array}$$

(17)

$$\frac{2}{3} \text{ of } \frac{3}{5} \times \frac{5}{12} = \frac{1}{6} = .1666\frac{2}{3}$$

$$\begin{array}{r} 1 \\ 6 \overline{)1.00000} \\ \hline .1666\frac{2}{3} \end{array}$$

(18)

$$\frac{1}{2} \text{ of } \frac{2}{3} \text{ of } \frac{7}{8} \div \frac{3}{4} \text{ of } \frac{2}{4} = \frac{7}{24} \times \frac{16}{3} = \frac{14}{9} = 1.5555\frac{5}{9}$$

(19)

$$\frac{4}{22} \text{ of } \frac{7}{8} = \frac{7}{44} = .15909\frac{4}{11}$$

(20)

$$\frac{9}{20} \text{ of } \frac{7}{1} \times \frac{11}{30} \text{ of } \frac{8}{11} = \frac{504}{5} = \$100.80$$

(21)

$$\frac{3}{8} + 7\frac{1}{2} + 8\frac{3}{4} = 16\frac{1}{2} = \$17.85 \text{ Ans.}$$

(22)

$$\frac{4}{3} \text{ of } 18 + 1\frac{8}{11} \text{ of } 1\frac{1}{2} + 7\frac{4}{9} = 13\frac{92}{36} = 30.6111\frac{1}{9} \text{ Ans.}$$

(23)

$$\frac{3}{8} \text{ of } 8\frac{3}{4} - \frac{2}{3} \text{ of } 3\frac{1}{2} = 2\frac{1}{2} = 2.9166\frac{2}{3} \text{ Ans.}$$

(24)

$$\frac{1}{2}\frac{6}{11} + \frac{1}{7} + \frac{2}{9} = \frac{179}{63} = 2.8412 + \text{ Ans.}$$

(1)

(2)

$$25 = \frac{25}{100} = \frac{1}{4}; .75 = \frac{75}{100} = \frac{3}{4} \quad .125 = \frac{125}{1000} = \frac{1}{8}; .625 = \frac{625}{1000} = \frac{5}{8}$$

(3)

$$.105 = \frac{105}{1000} = \frac{21}{200}; .0025 = \frac{25}{10000} = \frac{1}{400} \text{ Ans.}$$

(4)

$$.8015 = \frac{8015}{10000} = \frac{1603}{2000} ; 6042 = \frac{6042}{10000} = \frac{3021}{5000} \text{ Ans.}$$

(5)

$$68375 = \frac{68375}{100000} = \frac{547}{800} \text{ Ans.}$$

(6)

$$.01875 = \frac{1875}{100000} = \frac{3}{64} \text{ Ans}$$

(7)

$$22575 = \frac{22575}{100000} = \frac{903}{4000} \text{ Ans.}$$

(8)

$$.265625 = \frac{265625}{1000000} = \frac{17}{64} \text{ Ans.}$$

(9)

$$.333\frac{1}{3} = \frac{333\frac{1}{3}}{1000} = \frac{1000}{3000} = \frac{1}{3}$$

(10)

$$.5714\frac{2}{7} = \frac{5714\frac{2}{7}}{10000} = \frac{40000}{70000} = \frac{4}{7}$$

(1)

$$14 \text{ dr.} \div 16 = 875 \text{ oz.} ; .875 = 16 = .0546875 \text{ lb. Ans.}$$

(2)

$$78 \text{ d.} \div 12 = 6.5 \text{ s.} ; 6.5 \div 20 = \text{£} .325 \text{ Ans.}$$

(3)

$$63 \text{ pt.} \div 2 = 31.5 \text{ qt.} ; 31.5 \div 8 = 3.9375 \text{ pk. Ans.}$$

(4)

$$9 \text{ hr.} \div 24 = .375 \text{ da. Ans.}$$

(5)

$$375678 \text{ ft.} \div 16\frac{1}{2} \div 22768.363 \text{ rd.} + ; 22768.363 \div 320 = 71.1511 \text{ mi.} + \text{ Ans.}$$

(6)

$$19 \text{ pwt.} \div 20 = .95 \text{ oz.} ; 7.95 \div 12 = .6625 \text{ lb. Ans.}$$

(7)

$$8 \text{ oz.} \div 16 = .5 \text{ lb.} ; 7.5 \div 25 = .3 \text{ qr.} ; .3 \div 4 = .075 \text{ cwt.} ; 3.075 \div 20 = .15375 \text{ T. Ans.}$$

(8)

$$2.45s. \div 20 = \text{£}.1225 \text{ Ans.}$$

(9)

$$1.047 R. \div 4 = .26175 A. \text{ Ans.}$$

(10)

$$176.9 \text{ yd.} \div 5\frac{1}{2} = 32.16363 + \text{rd.} ; 32.16363 \div 40 = .80409 \text{ fur.} ; \\ .80409 \div 8 = .100511 \text{ mi. Ans.}$$

(11)

$$14 \text{ lb.} \div 25 = .56 \text{ qr.} ; 2.56 \div 4 = .64 \text{ cwt. Ans.}$$

(12)

$$16 \text{ gr.} \div 24 = .66666 + \text{pwt.} ; 18.66666 \div 20 = .933333 + \text{oz.} ; \\ 10.933333 \div 12 = .9111111 \text{ lb.} + \text{Ans.}$$

(13)

$$2 \text{ na.} \div 4 = .5 \text{ qr.} ; 3.5 \div 4 = .875 \text{ yd. Ans.}$$

(14)

$$1 \text{ gal.} \div 63 = .01587 + \text{hhd. Ans.}$$

(15)

$$43 \text{ sec.} \div 60 = .716666 + \text{min.} ; 6.716666 \div 60 = .1119444 \text{ hr.} ; \\ .7.1119444 \div 24 = .7129976 + \text{da. Ans.}$$

(16)

$$\frac{3}{4} = .6 ; 2.6 \text{ qr.} \div 4 = .65 \text{ cwt.} ; 4.65 \div 20 = .2325 \text{ T. Ans.}$$

(17)

$$2 \text{ far.} \div 4 = 5d. ; 5.5 \div 12 = .45833s. ; 19.45833 \div 20 = \\ \text{£}.97291 + \text{Ans.}$$

(18)

$$37 \text{ P.} \div 40 = .925 \text{ R.} ; 1.925 \div 4 = .48125 \text{ A. Ans.}$$

(19)

$$3 \text{ na.} \div 4 = .75 \text{ qr.} ; 2.75 \div 5 = .55 \text{ E.E. } \textit{Ans.}$$

(20)

$$\begin{aligned} 6.5 \text{ in.} \div 12 &= .541666 + \text{ft.} ; 2.541666 \div 3 = .847222 \text{ yd.} ; \\ 2.847222 \text{ yd.} \div 5\frac{1}{2} &= .5176767 + \text{rd.} ; 5176767 \div 40 = \\ .0129419 \text{ fur.} ; .0129419 \div 8 &= .0016177 \text{ mi.} + \end{aligned}$$

(21)

$$22.5'' \div 60 = .375' ; 15.375' \div 60 = .25625^\circ \textit{ Ans.}$$

(22)

$$1 \text{ lb.} \div 25 = .04 ; 1.04 \text{ qr.} \div 4 = .26 ; 1.26 \text{ cwt.} \div 20 = .063 \text{ T. } \textit{A.}$$

(23)

$$3 \text{ pk.} \div 4 = .75 \text{ bu.} ; 3.75 \div 36 = .10416 \text{ chal. } \textit{Ans.}$$

(24)

$$\begin{aligned} 6 \text{ in.} \div 12 &= .5 \text{ ft.} ; 1.5 \div 3 = .5 \text{ yd.} ; 17.5 \div 5\frac{1}{2} = 3.181818 \text{ rd.} ; \\ 3.181818 \div 40 &= .07954545 \text{ fur.} ; .07954545 \div 8 = .00994318 \text{ mi.} \end{aligned}$$

(25)

$$9.5 \text{ mo.} \div 12 = .791666 + \text{yr. } \textit{Ans.}$$

(26)

$$14 \text{ P} \div 40 = .35 \text{ R.} ; 1.35 \text{ R} \div 4 = .3375 \text{ A. } \textit{Ans.}$$

(27)

$$45 \text{ pk.} \div 4 = 11.25 \text{ bu.} ; 11.25 \div 36 = .3125 \text{ chal. } \textit{Ans.}$$

(28)

$$\begin{aligned} 72 \text{ yd.} \div 5\frac{1}{2} &= 13.090 \text{ rd.} ; 13.0909 \div 40 = .32727 \text{ fur.} ; \\ .32727 \div 8 &= .0409. + \text{mi. } \textit{Ans.} \end{aligned}$$

(29)

$$9 \div 24 = .375 ; .375 \div 20 = .01875 \text{ ream. } \textit{Ans.}$$

(30)

$$4.0125 \text{ in.} \div 12 = .334375 \text{ ft.} ; .334375 \div 16\frac{1}{2} = .020265 + \text{rd.}$$

(31)

$$10 \text{ wk.} + 2 \text{ da.} = 72 \text{ da.} ; 72 \div 366 = .19672 + \text{yr. } \textit{Ans.}$$

(32)

$$10 \text{ gr.} \div 20 = .5 \text{ } \mathfrak{D} ; 1.5 \div 3 = .5 \text{ } 3 ; 1.5 \div 8 = .1875 \text{ } \frac{3}{8} ; \\ 4.1875 \div 12 = .3489\overline{75} \text{ } \textit{Ans.}$$

(33)

$$1.75 \text{ pt.} \div 2 = .875 \text{ qt.} ; 3.875 \div 4 = .96875 \text{ gal.} ; \\ .96875 \div 63 = .01537 + \text{hhd. } \textit{Ans.}$$

(34)

$$1.8 \text{ sq. ft.} \div 9 = .2 \text{ sq. yd.} ; 24.2 \div 30\frac{1}{2} = .8 \text{ P.} ; 8 \div 40 = .02 \text{ R.} ; \\ .02 \div 4 = .005 \text{ A. } \textit{Ans.}$$

(1)

$$.6725 \text{ cwt.} \times 4 = 2.69 \text{ qr.} ; .69 \times 25 = 17.25 \text{ lb.} ; 25 \times 16 = 4 \text{ oz.} ; \\ 2 \text{ qr. } 17 \text{ lb. } 4 \text{ oz. } \textit{Ans.}$$

(2)

$$31 \text{ pi.} \times 2 = 1.22 \text{ hhd.} ; .22 \times 63 = 13.86 \text{ gal.} ; 86 \times 4 = 3.44 \text{ qt.} ; \\ 1 \text{ hhd. } 13 \text{ gal. } 3.44 \text{ qt. } \textit{Ans.}$$

(3)

$$\pounds 83229 \times 20 = 16.64580 ; .64580 \times 12 = 7.7496 \text{d.} ; \\ .7496 \times 4 = 2.99 + \text{far.} ; 16 \text{s. } 7 \text{d. } 2.99 \text{ far. } \textit{Ans.}$$

(4)

$$.0625 \text{ bbl.} \times 36 = 2.25 \text{ gal.} ; .25 \times 4 = 1 \text{ qt.} ; 2 \text{ gal. } 1 \text{ qt. } \textit{Ans.}$$

(5)

.42857 mo. $\times 4 = 1.71428$ wk. ; .71428 $\times 7 = 4.99996$ da. ;
 .99996 $\times 24 = 23.9904$ hr. ; .99904 $\times 60 = 59.9424$ min. ;
 .9424 $\times 60 = 56.5 +$ sec. ; 1 wk. 4 da. 23 hr. 59 min. 56.5 sec. *A.*

(6)

.05 A. $\times 4 = .20$ R. ; .20 $\times 40 = 8$ P. *Ans.*

(7)

.3375 T. $\times 20 = 6.75$ cwt. ; .75 $\times 4 = 3$ qr. ; 6 cwt. 3 qr. *Ans.*

(8)

.87 pi. $\times 2 = 1.75$ hhd. ; .75 $\times 63 = 47.25$ gal. ; .25 $\times 4 = 1$ qt. ;
 1 hhd. 47 gal. 1 qt. *Ans.*

(9)

.375 hhd. $\times 54 = 20.25$ gal. ; .25 $\times 4 = 1$ qt. ; 20 gal. 1 qt. *Ans.*

(10)

.911111 lb. $\times 12 = 10.933332$ oz. ; .933332 $\times 20 = 18.66664$ pwt. ;
 .66664 $\times 24 = 15.99 +$ gr. ; 10 oz. 18 pwt. 15.99 gr. *Ans.*

(11)

.675 E. E. $\times 5 = 3.375$ qr. ; .375 $\times 4 = 1.5$ na. ; 3 qr. 1.5 na. *A.*

(12)

.001136 $\times 8 \times 40 \times 16\frac{1}{2} = 5.99808$ ft. ;
 .99808 $\times 12 = 11.9 +$ in. = 5 ft. 11.9 + in. *Ans.*

(13)

000242 sq. mi. $\times 640 \times 4 \times 40 = 24.7808$ P. ; .7808 P. $\times 30\frac{1}{2} =$
 23.6192 sq. yd. ; .6192 sq. yd. $\times 9 = 5.5728$ sq. ft. ;
 .5728 sq. ft. $\times 144 = 82.4832$ sq. in. ;
 24 P. 23 sq. yd. 5 sq. ft. 82.4832 sq. in. *Ans.*

(14)

.4629 deg. $\times 69\frac{1}{2}$ = 32.17155 mi. ; .17155 mi. $\times 8$ = 1.3724 fur. ;
 .3724 fur. $\times 40$ = 14.896 rd. ; .896 rd. $\times 16\frac{1}{2}$ = 14.784 ft. ;
 .784 ft. $\times 12$ = 9.408 in. ; 32 mi. 1 fur. 14 rd. 14 ft. 9.408 in.

(15)

.875 yd. $\times 3$ = 2.625 ft. ; .625 $\times 12$ = 7.5 in. ; 2 ft. 7.5 in. *Ans*

(16)

.3489 lb $\times 12$ = 4.1868 $\frac{2}{3}$; .1868 $\times 8$ = 1.4944 3 ; .4944 $\times 3$ =
 1.4832 \supset ; .4832 $\times 20$ = 9.6 + gr. ; 4 $\frac{2}{3}$ 13 1 \supset 9.6 gr.

(17)

.759 A. $\times 4$ = 3.036 R. ; .036 $\times 40$ = 1.44 P. ; .44 $\times 30\frac{1}{4}$ =
 13.31 sq. yd. ; 3 R. 1 P. 13.31 sq. yd. *Ans.*

(18)

.01875 $\times 20$ = .375 quires ; .375 $\times 24$ = 9 sheets. *Ans.*

(19)

0055 T. $\times 20$ = .11 cwt. ; .11 $\times 4$ = .44 qr. ; .44 $\times 25$ = 11 lb. *A.*

(20)

.625s. $\times 12$ = 7.5d. ; .5 $\times 4$ = 2. far. ; 7d. 2 far. *Ans.*

(21)

.8375 A. $\times 4$ = 1.35 R. ; .35 $\times 40$ = 14 P. ; 1 R. 14 P. *Ans.*

(22)

.785 yr. $\times 365\frac{1}{4}$ = 286.72125 da. ; .72125 $\times 24$ = 17.31 hr. ;
 .31 $\times 60$ = 18 min. 36 sec. ; 286 da. 17 hr. 18 min. 36 sec. *A.*

REPEATING DECIMALS.

$$(1) \quad \frac{1}{15} = .06 \text{ A.} \quad (2) \quad \frac{13}{16} = .08125 \text{ A.} \quad (3) \quad \frac{11}{32} = .034375 \text{ A.}$$

$$(4) \quad \frac{17}{128} = .01328125 \text{ A.} \quad (5) \quad \frac{11}{64} = .0171875 \text{ A.} \quad (6) \quad \frac{17}{160} = .034 \text{ A.}$$

$$(7) \quad \frac{7}{15} = .028 \text{ Ans.} \quad (8) \quad \frac{31}{160} = .02421875 \text{ Ans.}$$

$$(1) \quad \frac{5}{7} = .714285\frac{5}{7} \text{ Ans.} \quad (2) \quad \frac{4}{5} = .26666\frac{2}{3} \text{ Ans.}$$

$$(3) \quad \frac{5}{11} = .454545\frac{5}{11} \text{ Ans.} \quad (4) \quad \frac{7}{18} = .38888\frac{1}{3} = .38888\frac{2}{3} \text{ Ans.}$$

REDUCTION OF REPETENDS TO COMMON FRACTIONS.

$$(3) \quad \begin{aligned} .6' &= \frac{6}{10} = \frac{3}{5}; \quad .162' = \frac{162}{1000} = \frac{81}{500}; \quad .769230' = \frac{769230}{1000000} = \frac{1}{13}; \\ .945' &= \frac{945}{1000} = \frac{105}{111} = \frac{35}{37}; \quad .09' = \frac{9}{100} = \frac{1}{11} \end{aligned}$$

$$(4) \quad \begin{aligned} .594405' &= \frac{594405}{1000000} = \frac{85}{143}; \quad .86' = \frac{86}{100} = \frac{4}{11}; \\ .142857' &= \frac{142857}{1000000} = \frac{1}{7} \end{aligned}$$

$$(4) \quad \begin{aligned} 13'8' &= \frac{13}{100} + \frac{8}{1000} = \frac{128}{1000} = \frac{8}{625}; \quad 7.5'43' = 7 + \frac{5}{10} + \frac{43}{1000} = \frac{7543}{1000} = \\ 7\frac{269}{1000}; \quad .04'354' &= \frac{4}{100} + \frac{354}{100000} = \frac{4350}{100000} = \frac{29}{6666}; \quad 37.5'4' = 37 + \\ \frac{5}{10} + \frac{4}{100} &= 37\frac{49}{100}; \quad .6'75' = \frac{6}{10} + \frac{75}{1000} = \frac{669}{1000} = \frac{223}{333}; \quad .7'54347' = \\ \frac{7}{10} + \frac{54347}{1000000} &= \frac{754347}{1000000} \end{aligned}$$

(5)

$$\begin{aligned}
 .7'5' &= \frac{7}{10} + \frac{5}{90} = \frac{68}{90} = \frac{34}{45}; & .4'38' &= \frac{4}{10} + \frac{38}{990} = \frac{434}{990} = \frac{217}{495}; \\
 .09'3' &= \frac{9}{100} + \frac{3}{900} = \frac{84}{900} = \frac{7}{75}; & 4.7'543' &= 4 + \frac{7}{10} + \frac{543}{9990} = \\
 & & 4\frac{1256}{9990}; & .009'87' &= 4\frac{7536}{9990} = \frac{9}{1000} + \frac{87}{99000} = \frac{978}{99000} = \frac{193}{16500}; \\
 .4'5' &= \frac{4}{10} + \frac{5}{90} = \frac{41}{90}
 \end{aligned}$$

(2)

$$\frac{219}{1170} = .1875 \quad \text{it has no repetend but 0.}$$

(3)

$$\frac{4}{1170} = .0'0344827586206896551724137931'$$

(4)

$$\frac{12}{125} = .09756'; \quad \frac{80}{125} = .592'; \quad \frac{72}{125} = .5'3'$$

(2)

$$\begin{aligned}
 2.4'181818' \\
 .5'925925' \\
 .008'497133'
 \end{aligned}$$

(3)

$$\begin{aligned}
 165.16'416416' \\
 .04'040404' \\
 .03'777777'
 \end{aligned}$$

(4)

$$\begin{aligned}
 .5'333333' \\
 .4'757575' \\
 1.7'577577'
 \end{aligned}$$

ADDITION.

(2)

$$\begin{array}{r}
 67.3'454545' \quad 4 \\
 9.6'516516' \quad 5 \\
 .2'525252' \quad 5 \\
 17.4'777777' \quad 7 \\
 .5'555555' \quad 5 \\
 \hline
 95.2'829647' \quad (2)26
 \end{array}$$

(3)

$$\begin{array}{r}
 .47'547547' \quad 5 \\
 3.75'434434' \quad 4 \\
 64.75'757575' \quad 7 \\
 .57'575757' \quad 5 \\
 .17'887887' \quad 8 \\
 \hline
 69.74'203112' \quad (3)29
 \end{array}$$

(4)

$$\begin{array}{r}
 .5'555555555555' \quad 5 \\
 4.3'777777777777' \quad 7 \\
 49.4'575757575757' \quad 5 \\
 .4'954954954954' \quad 9 \\
 .7'345734573457' \quad 3 \\
 \hline
 55.6'209780437508' \quad 29
 \end{array}$$

(5)

$$\begin{array}{r}
 .1'751751' \quad 7 \\
 42.5'757575' \quad 7 \\
 .3'753753' \quad 7 \\
 .4'954954' \quad 9 \\
 3.7'545454' \quad 5 \\
 \hline
 47.3'763490' \quad 35
 \end{array}$$

(6)

$$\begin{array}{r}
 165.0'000000' \\
 .1'641641' \quad 6 \\
 147.0'404040' \quad 4 \\
 .4'9595959' \quad 5 \\
 94.3'777777' \quad 7 \\
 4.7'123457' \quad 1 \\
 \hline
 416.2'542876' \quad 23
 \end{array}$$

SUBTRACTION.

$$\begin{array}{r} (2) \\ 47.5'333' \quad 3 \\ \underline{1.7'577' \quad 5} \quad - \\ 45.7'755' \end{array}$$

$$\begin{array}{r} (3) \\ 17.5'735' \quad 73 \\ \underline{14.5'777' \quad 77} \quad - \\ 2.9'957' \end{array}$$

$$\begin{array}{r} (4) \\ 17.43'3' \\ \underline{12.34'3'} \\ 5.09'0' \end{array}$$

$$\begin{array}{r} (5) \\ 1.12'754754754754' \quad 7 \\ \underline{.47'384788473847' \quad 3} \quad - \\ .65'370016280907' \end{array}$$

$$\begin{array}{r} (6) \\ 4.75'0' \quad 0 \\ \underline{.37'5' \quad 5} \quad - \\ 4.37'4' \end{array}$$

$$\begin{array}{r} (7) \\ 4.794'000' \quad 0 \\ \underline{.174'474' \quad 4} \quad - \\ 4.619'525' \end{array}$$

$$\begin{array}{r} (8) \\ 1.4577'7' \\ \underline{.3654'0'} \\ 1.0923'7' \end{array}$$

$$\begin{array}{r} (9) \\ 1.4937'937' \\ \underline{.1475'000'} \\ 1.3462'937' \end{array}$$

MULTIPLICATION.

$$\begin{array}{c} (2) \\ 59 \\ .375'4' \times 14.75 = \frac{3379}{\cancel{9999} \quad 360} \times \frac{\cancel{1475}}{100} = \frac{199361}{36000} = \frac{512331}{\cancel{36000}} = 5.53780'5' \end{array}$$

$$\begin{array}{c} (3) \\ 4'253' \times 2.57 = \frac{4249}{9990} \times \frac{257}{100} = \frac{1091993}{999000} = 1.\frac{92993}{999000} = 1.093'086' \end{array}$$

$$\begin{array}{c} (4) \\ .437 \times 3.7'5' = \frac{437}{1000} \times \frac{395}{100} = \frac{173853}{130000} = 1.\frac{38853}{130000} = 1.6411'7' \text{ Ans.} \end{array}$$

$$4.573 \times .375' = \frac{4573}{1000} \times \frac{375}{1000} = \frac{1717875}{1000000} = \frac{1717875}{1000000} = 1.717875'$$

$$(6) \quad 3.456' \times .425' = \frac{3456}{1000} \times \frac{425}{1000} = \frac{1468800}{1000000} = \frac{1468800}{1000000} = 1.4688'$$

$$(7) \quad 1.456' \times 4.23' = \frac{1456}{1000} \times \frac{423}{100} = \frac{615792}{100000} = \frac{615792}{100000} = 6.15792'$$

$$(8) \quad 45.13' \times .245' = \frac{4513}{100} \times \frac{245}{1000} = \frac{1105685}{100000} = \frac{1105685}{100000} = 11.05685'$$

11.068735402' Ans.

$$(9) \quad .47053' \times 1.735' = \frac{47053}{100000} \times \frac{1735}{1000} = \frac{816541675}{100000000} = \frac{816541675}{100000000} = 8.16541675'$$

DIVISION.

$$(2) \quad 24.818' \div 1.792 = \frac{24818}{1000} \div \frac{1792}{1000} = \frac{24818}{1792} = 13.849330357142857'$$

$$(3) \quad 8.5968 \div .245' = \frac{85968}{10000} \div \frac{245}{1000} = \frac{85968}{2450} = 35.1298'$$

$$(4) \quad 2.295 \div .297' = \frac{2295}{1000} \div \frac{297}{1000} = \frac{2295}{297} = 7.727272727272727'$$

$$(5) \quad 47.345 \div 1.76' = \frac{47345}{1000} \div \frac{176}{100} = \frac{47345}{1760} = 26.897727272727272'$$

26.897727272727272' Ans.

$$(6) \quad 13.5169533' \div 4.297' = \frac{135169533}{10000000} \div \frac{4297}{1000} = \frac{135169533}{42970000} = 3.145741144752129'$$

3.145741144752129' Ans.

(7)

$$.45' \div .118881' = \frac{45}{99} \times \frac{999999}{118881} = \frac{16835}{4403} =$$

$$3.8235294117647058' \text{ Ans.}$$

(8)

$$.475' \div .3753' = \frac{475}{999} \div \frac{3753}{9990} = 1\frac{2}{5} = 1.4 = 1.26' \text{ Ans.}$$

(9)

$$3.753' \div .24' = 3\frac{753}{999} \div \frac{24}{99} = \frac{9875}{444} = 15.48423' \text{ Ans.}$$

CONTINUED FRACTIONS.

(2)

$$\frac{21}{39} = \frac{1}{1+1} = 1$$

$$\frac{1}{1+\frac{1}{6}} = \frac{1}{2}$$

(3)

$$\frac{47}{65} = \frac{1}{1+1} = 1$$

$$\frac{1}{2+1} = \frac{1}{3}$$

$$\frac{1}{1+1} = \frac{1}{2}$$

(4)

$$\frac{17}{27} = \frac{1}{1+1} = 1$$

$$\frac{1}{1+1} = \frac{1}{2}$$

$$\frac{1}{1+1} = \frac{1}{2}$$

$$\frac{1}{2+\frac{1}{3}} = \frac{3}{7}$$

(5)

$$\frac{67}{85} = \frac{1}{1+1} = 1$$

$$\frac{1}{3+1} = \frac{1}{4}$$

$$\frac{1}{1+1} = \frac{1}{2}$$

(6)

$$\frac{37}{87} = \frac{1}{2+1} = \frac{1}{3}$$

$$\frac{1}{2+1} = \frac{1}{3}$$

$$\frac{1}{1+1} = \frac{1}{2}$$

$$\frac{1}{5+\frac{1}{2}} = \frac{2}{17}$$

$$\frac{1}{1+1} = \frac{1}{2}$$

$$\frac{1}{1+\frac{1}{2}} = \frac{2}{3}$$

(7)

5 hr. 48 min. 48 sec. = excess =

$$\frac{20928}{88400} \text{ da.} = \frac{109}{450} \text{ da.} = 1$$

$$\frac{1}{4+1} = \frac{1}{5}$$

$$\frac{1}{7+1} = \frac{1}{8}$$

$$\frac{1}{1+1} = \frac{1}{2}$$

$$\frac{1}{3+1} = \frac{1}{4}$$

$$\frac{1}{1+\frac{1}{2}} = \frac{2}{3}$$

$$(\frac{31}{128} + \frac{39}{161}) \div 2 = \frac{9983}{41216} \text{ A.}$$

(2)

$$6 : 24 \text{ is } \frac{24}{6} = 4$$

(3)

$$7 : 35 \text{ is } \frac{35}{7} = 5$$

(4)

$$15 : 6 \text{ is } \frac{6}{15} = \frac{2}{5}$$

(5)

$$5 \times 4 : 6 \times 10 \text{ is } \frac{60}{20} = 3 \text{ A.}$$

(6)

$$6 \times 3 : 9 \times 4 \text{ is } \frac{36}{18} = 2$$

(7)

$$4 \times 9 \times 3 : 5 \times 8 \times 5 \text{ is } \frac{5 \times 8 \times 5}{4 \times 9 \times 3} = \frac{50}{27} = 1\frac{23}{27} \text{ Ans.}$$

(8)

$$6 : 4 \text{ is } \frac{4}{6} = \frac{2}{3}$$

(9)

$$10 : 5 \text{ is } \frac{5}{10} = \frac{1}{2}$$

(10)

$$34 : 17 \text{ is } \frac{17}{34} = \frac{1}{2}$$

(11)

$$450 : 300 \text{ is } \frac{300}{450} = \frac{2}{3}$$

(12)

$$96 : 16 \text{ is } \frac{16}{96} = \frac{1}{6}$$

(13)

$$12 : 8 \text{ is } \frac{8}{12} = \frac{2}{3}$$

(14)

$$48 : 16 \text{ is } \frac{16}{48} = \frac{1}{3}$$

(15)

$$90 : 18 \text{ is } \frac{18}{90} = \frac{1}{5}$$

(16)

$$165 : 15 \text{ is } \frac{15}{165} = \frac{1}{11}$$

(17)

$$11 : 9 \text{ is } \frac{9}{11} \text{ A.}$$

(1)

$$16 \times 7 = 112 \text{ A.}$$

(2)

$$30 \div 6 = 5 \text{ A.}$$

(3)

$$15 \times 4 = 60 \text{ Ans.}$$

(4)

$$7 \div 1\frac{1}{2} = 5 \text{ Ans.}$$

(5)

$$\frac{4}{5} \times \frac{7}{8} = \frac{7}{10} \text{ A.}$$

(6)

$$256 \div 8 = 32$$

(7)

$$14 \times 5 \times 10 \div 25 = 28$$

(8)

$$143 \div 2\frac{1}{2} = 56\frac{2}{5}$$

(1)

$$5 : 30 :: 10 : x = \frac{30 \times 10}{5} = 60 \text{ Ans.}$$

(2)

$$9 : x :: 12 : 36; x = \frac{36 \times 9}{12} = 27 \text{ Ans.}$$

(3)

$$15 : 45 :: x : 27; \frac{15 \times 27}{45} = 9 \text{ Ans.}$$

(4)

$$\frac{1}{2} : \frac{1}{20} :: x : \frac{1}{32}; x = \frac{1}{2} \times \frac{1}{32} \times 20 = \frac{1}{8} \text{ Ans.}$$

(5)

$$5 : 10 :: 9 : x = \frac{10 \times 9}{5} = 18 \text{ Ans.}$$

(6)

$$6 : 24 :: 14 : x = \frac{24 \times 14}{6} = 56 \text{ Ans.}$$

(7)

$$9 : 12 :: x : 16; x = \frac{16 \times 9}{12} = 12 \text{ Ans.}$$

(8)

$$16 : x :: 8 : 20; x = \frac{16 \times 20}{8} = 40 \text{ Ans.}$$

SINGLE RULE OF THREE.

(1)

hats.	hats.	\$
8	: 110	:: 24 : x = \$330.

$$\frac{110 \times 24}{8} = \$330 \text{ Ans.}$$

(2)

bbl.	bbl.	\$
2	: 12	:: 15 : x = \$90

$$\frac{12 \times 15}{2} = \$90 \text{ Ans.}$$

(3)

$$\begin{array}{cccc} \text{da.} & \text{da.} & \text{mi.} & \text{mi.} \\ 6 : 18 :: 168 : x = 504 \end{array}$$

$$\frac{168 \times 3}{18} = 504 \text{ mi. Ans.}$$

(4)

$$\begin{array}{cccc} \text{lb.} & \text{lb.} & \$ & \\ 8 : 13 :: 1.28 : x = \$2.08 \end{array}$$

$$\frac{13 \times 1.28}{8} = 2.08 \text{ Ans.}$$

(5)

$$\begin{array}{cccc} \text{bbl.} & \text{bbl.} & \$ & \\ 300 : 125 :: 2100 : x = \$875 \end{array}$$

$$\frac{125 \times 2100}{300} = \$875 \text{ Ans.}$$

(6)

$$\begin{array}{cccc} \text{sh.} & \text{sh.} & \text{lb.} & \text{lb.} \\ 120 : 36 :: 330 : x = 99 \text{ lb.} \end{array}$$

$$\frac{36 \times 330}{120} = 99 \text{ lb. Ans.}$$

(7)

$$\begin{array}{cccc} \text{yd.} & \text{yd.} & \$ & \$ \\ 80 : 650 :: 340 : x = \$2762.50 \end{array}$$

$$\frac{340 \times 650}{80} = \$2762.50 \text{ Ans.}$$

(8)

$$\begin{array}{cccc} \text{lb.} & \text{lb.} & \$ & \$ \\ 1 : 400 :: .05 : x = \$20.00 \end{array}$$

$$400 \times .05 = \$20.00 \text{ Ans.}$$

(9)

$$\begin{array}{cccc} \text{gal.} & & \text{gal.} & \$ \\ 6 : 6 \times 63 = 378 :: 1.95 : x = \$122.85 \end{array}$$

$$\frac{378 \times 1.95}{6} = \$122.85 \text{ Ans.}$$

(10)

$$\begin{array}{cccc} \text{men.} & \text{men.} & \text{lb.} & \text{lb.} \\ 16 : 40 :: 560 : x = 1400 \text{ lb.} \end{array}$$

$$\frac{40 \times 560}{16} = 1400 \text{ lb. Ans.}$$

(11)

$$\begin{array}{ccc} \text{da.} & & \text{da.} \quad \text{mi.} \\ 12 : 366-52=314 & :: & 630 : x=16485 \text{ mi.} \end{array}$$

$$\frac{157 \quad 105}{\cancel{314} \times \cancel{630}} = 16485 \text{ mi. } A.$$

$$\frac{12}{2}$$

(12)

$$\begin{array}{ccc} \text{yd.} & & \text{yd.} \quad \text{¢} \\ 2 : 25 \times 3 = 75 & :: & 3.25 : x = \$121.87\frac{1}{2} \end{array}$$

$$\frac{75 \times 3.25}{2} = \$121.87\frac{1}{2} \text{ Ans.}$$

(13)

$$\begin{array}{ccc} \text{yd.} & \text{yd.} & \text{a.} \\ 3 : 36 & :: & 18 : x = 216 = \$27 \end{array} \quad \frac{36 \times 18}{3} = .216\text{s.}; \frac{216}{8} = \$27$$

(14)

$$\begin{array}{ccc} \text{a.} & \text{d.} & \text{a.} \quad \text{d.} \quad \text{oz.} \\ 8 & 4 : 7 & 6 : : 8 : x = 7\frac{1}{2} \end{array}$$

$$\frac{12}{100} \quad \frac{12}{90}$$

$$\frac{18 \quad 2}{\cancel{90} \times \cancel{8}} = \frac{36}{5} = 7\frac{1}{5} \text{ oz}$$

(15)

$$\begin{array}{ccc} 5 \text{ A. } 1 \text{ R. } 16 \text{ P.} & : & 125 \text{ A. } 2 \text{ R. } 20 \text{ P.} : : \$150.5 : x \\ \begin{array}{r} 4 \\ \overline{21} \\ 40 \\ \overline{856} \end{array} & & \begin{array}{r} 4 \\ \overline{502} \\ 40 \\ \overline{20100} \end{array} \end{array}$$

$$\frac{5025 \quad 75.25}{\cancel{20100} \times \cancel{150.50}} = \$3533.936$$

$$\frac{556}{214}$$

$$107$$

(16)

$$\begin{array}{ccc} \text{cwt.} & \text{qr.} & \text{cwt.} \\ 13 & 2 : 9 & :: \$129.93 : x \\ \begin{array}{r} 3 \\ \overline{54} \end{array} & & \begin{array}{r} 4 \\ \overline{36} \end{array} \end{array}$$

$$\frac{2 \quad 43.31}{\cancel{36} \times \cancel{129.93}} = \$86.62 \text{ } A.$$

$$\frac{54}{3}$$

(17)

$$\begin{array}{ccccccc} \text{men.} & & \text{men.} & & \text{£} & & \text{s.} \\ 750 & : & 10500 & :: & 2834 & 5 & : x \end{array}$$

$$\frac{20}{56685}$$

$$\begin{array}{r} 11337 \quad 210 \\ 56685 \times 10500 \\ \hline 750 \times 20 \text{ s. } (= £1) = \frac{19359}{2} = £39679\frac{1}{2} \text{ Ans.} \end{array}$$

(18)

$$\begin{array}{ccc} \text{yd.} & \text{yd.} & \text{yd.} \\ \frac{5}{8} & : & \frac{3}{2} :: \frac{15}{4} : x = 9 \text{ yd.} \end{array}$$

$$\frac{3}{2} \times \frac{15}{4} \times \frac{8}{5} = 9 \text{ yd. Ans.}$$

(19)

$$\begin{array}{ccc} \text{rd.} & \text{rd.} & \text{rd.} \\ 7 & : & \frac{7}{2} :: \frac{84}{5} : x = 8\frac{2}{5} \text{ rd.} \end{array}$$

$$\frac{7}{2} \times \frac{42}{5} \times \frac{1}{7} = \frac{42}{5} = 8\frac{2}{5} \text{ rd. A.}$$

(20)

$$\begin{array}{cccc} \text{ft.} & \text{ft.} & \text{ft.} & \text{ft.} \\ \frac{3}{4} \times 3 = \frac{9}{4} & : & 30 & :: 36 : x = 480 \end{array}$$

$$\frac{30}{1} \times \frac{36}{1} \times \frac{4}{9} = 480 \text{ ft.} = 160 \text{ yd.}$$

(21)

$$\begin{array}{cccc} \text{hr.} & \text{hr.} & \text{da.} & \text{da.} \\ 10 & : & 9 & :: 8 : x = 7\frac{1}{2} \end{array}$$

$$\frac{9 \times 8}{10} = \frac{36}{5} = 7\frac{1}{2} \text{ da. Ans.}$$

(22)

$$\begin{array}{ccc} \text{mo.} & \text{mo.} & \text{persons.} \\ 24 & : & 8 :: 15 : x \end{array}$$

$$\frac{8 \times 15}{24} = 5 \text{ persons for 2 years.}$$

15 - 5 = 10 = number to be diminished. *Ans.*

(23)

$$\begin{array}{cccccc} \text{yr.} & \text{mo.} & \text{mo.} & \text{mo.} & \text{men.} & \text{men.} \\ 2 & 6 = 30 & : & 6 & :: 4600 & : x = 920 \end{array}$$

$$\frac{4600 \times 6}{30} = 920 \text{ men. Ans.}$$

(24)

$$\begin{array}{ccc} \text{mon.} & \text{mon.} & \text{da.} \\ 15000 : 9000 :: 90 : x = 54 \text{ da.} \end{array} \quad \begin{array}{c} 3 \quad 18 \\ \cancel{9000} \times \cancel{90} \\ \hline 15000 \\ \$ \end{array} = 54 \text{ da. } A.$$

(25)

$$\begin{array}{ccc} \text{yd.} & \text{qr.} & \text{yd.} & \text{qr.} \\ 3 & 2 : 8 & 3 & :: \$15.75 : x \end{array} \quad \begin{array}{c} 5 \\ \cancel{35} \times \cancel{15.75} \\ \hline 14 \\ 2 \end{array} = \$39.375 \text{ Ans.}$$

$$\frac{4}{14} \quad \frac{4}{35}$$

(26)

$$\begin{array}{ccc} \text{h.} & \text{h.} & \$ \\ .5 : .95 :: 201.5 : x = \$382.85 \end{array} \quad \begin{array}{c} 1.9 \\ \cancel{.95} \times \cancel{201.5} \\ \hline .5 \end{array} = \$382.85 \text{ Ans.}$$

(27)

$$\begin{array}{ccc} \text{bu.} & \text{bu.} & \$ \\ 3.5 : 26.25 :: 8.40 : x = \$63.00 \end{array} \quad \begin{array}{c} 52.5 \quad 1.20 \\ \cancel{26.25} \times \cancel{8.40} \\ \hline 3.5 \\ .5 \end{array} = \$63.00 \text{ A.}$$

(28)

$$2.5 \times 20 = 50 \text{ cwt.} : 1 \text{ cwt.} :: \$1.80 : x = \$0.036$$

$$\begin{array}{c} .18 \\ 1 \times \cancel{1.80} \\ \hline 50 \\ 5 \end{array} = \frac{.18}{5} = \$0.036 \text{ Ans.}$$

(29)

$$\frac{1}{4} \text{ yd.} : 447 \times 5\frac{1}{2} = \frac{4917}{2} \text{ yd.} :: \$2.16 : x$$

$$\frac{\cancel{4917}}{2} \times \frac{\cancel{2.16}}{1} \times \frac{4}{3} = \$7080.48 \text{ Ans.}$$

(30)

$$\begin{array}{ccc} \text{oz.} & \text{oz.} & \$ \\ \frac{1}{4} : \frac{3}{4} :: 1\frac{1}{2} : x = \$1.925 \end{array} \quad \frac{3}{4} \times 1\frac{1}{2} \times \frac{1}{5} = \frac{9}{10} = 1.925 \text{ A.}$$

(31)

$$\begin{array}{ccc} \text{lb.} & \text{lb.} & \$ \\ \frac{11}{3} : \frac{64}{5} :: \frac{11}{6} : x = \$2.10 \end{array} \quad \begin{array}{c} 21 \\ \cancel{64} \times \cancel{11} \times \frac{3}{44} \\ \hline 5 \quad 2 \quad 4 \end{array} = \frac{21}{10} = \$2.10 \text{ A.}$$

(32)

$$\begin{array}{ccc} \text{yd.} & \text{yd.} & \$ \\ 2\frac{2}{3} : 3\frac{1}{8} :: 5\frac{8}{3} : x = \$52.50 \end{array}$$

$$\frac{105}{315} \times \frac{2}{58} \times \frac{2}{29} = \frac{105}{2} = \$52.50 \text{ A.}$$

(33)

$$\begin{array}{ccc} \text{bbl.} & \text{bbl.} & \$ \\ 7 : 1\frac{1}{4} :: 9 : x \end{array}$$

$$\frac{11}{14} \times \frac{9}{11} \times \frac{8}{7} = \$2\frac{6}{7} \text{ Ans.}$$

(34)

$$\begin{array}{ccc} \text{sh.} & \text{sh.} & \$ \\ 1\frac{3}{16} : 1\frac{1}{2} :: 2880 : x = \$7200 \end{array}$$

$$\frac{5}{15} \times \frac{1440}{2880} \times \frac{16}{3} = \$7200$$

(35)

$$\begin{array}{ccc} \text{yd.} & \text{yd.} & \$ \\ 462 : 116\frac{1}{4} :: 150.66 : x = \$37.909 + \end{array}$$

$$\frac{155}{465} \times \frac{75.33}{150.66} \times \frac{1}{154} = \$37.909 + \text{ Ans.}$$

(36)

The work of 6 men and 3 boys equals $7\frac{1}{2}$ times the work of one man; the work of 9 men and 4 boys equals that of 11 men;

$$\begin{array}{ccc} \text{men.} & \text{men.} & \text{da.} \\ 11 : 7\frac{1}{2} :: 330 : x = 225 \text{ da.} \end{array}$$

$$\frac{15}{2} \times \frac{330}{1} \times \frac{1}{11} = 225 \text{ da. A.}$$

(37)

$$\begin{array}{ccc} \text{men.} & \text{men.} & \text{da.} \\ 16 : 4 :: 80 : x = 20 \text{ da.} \end{array}$$

$$\frac{4 \times 80}{16} = 20 \text{ da. Ans.}$$

(38)

$$\begin{array}{ccc} \text{men.} & \text{men.} & \text{da.} \\ 7 : 21 :: 18 : x = 54 \text{ da. Ans.} \end{array}$$

$$\frac{3 \times 18}{7} = 54 \text{ da. Ans.}$$

$$\begin{array}{ccc} \text{men.} & \text{men.} & \text{da.} \\ 10 : 20 :: 6 : x = 12 \text{ da.} \end{array} \quad (39) \quad \frac{2}{20 \times 6} = 12 \text{ da. } \textit{Ans.}$$

$$\begin{array}{ccc} \text{men.} & \text{men.} & \text{da.} \\ 20 : 10 :: 12 : x = 6 \text{ da.} \end{array} \quad (40) \quad \frac{6}{10 \times 12} = 6 \text{ da. } \textit{Ans.}$$

$$\begin{array}{ccc} \text{men.} & \text{men.} & \text{da.} \\ 75 : 100 :: 120 : x = 160 \text{ da.} \end{array} \quad (41) \quad \frac{4}{100 \times 120} = 160 \text{ da. } \textit{Ans.}$$

$$\begin{array}{ccc} \text{hr.} & \text{hr.} & \text{da.} \\ 11.9 : 13.566 :: 35.5 : x = 40.47 \text{ da.} \end{array} \quad (42) \quad \frac{13.566 \times 35.5}{11.9} = 40.47 \text{ da. } \textit{Ans.}$$

$$\begin{array}{ccc} \text{per.} & \text{per.} & \text{yr.} \\ 5 : 50 :: 1 : x = 10 \text{ yr.} \end{array} \quad (43) \quad \frac{50 \times 1}{5} = 10 \text{ yr. } \textit{Ans.}$$

$$\begin{array}{ccc} \text{hr.} & \text{hr.} & \text{da.} \\ 9 : 4 :: 12 : x = 5\frac{1}{3} \text{ da.} \end{array} \quad (44) \quad \frac{4 \times 12}{9} = 5\frac{1}{3} \text{ da. } \textit{Ans.}$$

$$\begin{array}{ccc} \text{bbl.} & \text{bbl.} & \$ \\ 34 : 162 :: 12\frac{1}{2} : x = \$132.589 \end{array} \quad (45)$$

$$\frac{27}{162} \times \frac{25}{125} \times \frac{11}{84} = \$132.589 \text{ Ans.}$$

(46)

$$\begin{array}{ccccccc} \$ & & \$ & & \text{bu.} & \text{pk.} & \\ 1.9375 : 96.875 :: 2 & 1 : x & & & & & \\ & & & & \frac{4}{9} & & \end{array} \quad \frac{96.875 \times 9}{1.9375} = 112\frac{1}{2} \text{ bu. } Ans.$$

(47)

$$\begin{array}{ccccccc} \text{yd.} & & \text{yd.} & & \$ & & \\ \frac{5}{8} : \frac{15}{2} :: \frac{14}{9} : x = \$18.66\frac{2}{3} & & & & & & \\ & & & & \frac{4}{3} & & \end{array} \quad \frac{15}{2} \times \frac{14}{9} \times \frac{8}{5} = \frac{56}{3} = \$18.66\frac{2}{3} \text{ } Ans.$$

(48)

$$\begin{array}{ccccccc} \text{yd.} & & \text{yd.} & & \$ & & \\ 47.5 : 37.05 :: 72.25 : x = \$56.355 & & & & & & \\ & & & & \frac{37.05 \times 72.25}{47.5} = \$56.355 \text{ } Ans. & & \end{array}$$

(49)

$$\begin{array}{ccccccc} \text{pa.} & & \text{pa.} & & \text{yd.} & & \\ 3 : 160 :: 2 : x = 106\frac{2}{3} \text{ yd.} & & & & \frac{160 \times 2}{3} = 106\frac{2}{3} \text{ yd. } Ans. & & \end{array}$$

(50)

$$\begin{array}{ccccccc} \text{guin.} & & \text{a} & & \text{£} & & \text{a} & & \text{wk.} & & \\ \frac{1}{2} = 10\frac{1}{2} : 21 = 420 :: 1 : x = 40 \text{ wk.} & & & & & & & & \frac{20}{21} \times 1 \times 2 = 40 \text{ wk.} & & \end{array}$$

(51)

$$\begin{array}{ccccccc} \text{doz.} & & \text{copies.} & & \text{copies.} & & \$ & & \\ 12 = 144 : 297 :: 54.72 : x & & & & & & \frac{33}{297} \times 54.72 = \$112.86 & & \\ & & & & & & \frac{144}{16} & & \end{array}$$

(52)

$$\begin{array}{ccccccc} \text{men.} & & \text{men.} & & \$ & & \\ 900 : 4500 :: 3618 : x = \$18090 & & & & & & \end{array}$$

$$\frac{4500 \times 3618}{900} = \$18090 \text{ } Ans.$$

(53)

The rum at 80 cts. a gallon costs . . \$50.40

The rum at 60 cts. a gallon costs . . 37.80

Leaving a difference of . . . \$12.60 which must
be made up by water, also at 60 cts. a gallon : How much
water is required ?

$$\begin{array}{ccccccc} \text{cts.} & \$ & & \text{gal.} & & & \\ 60 : 12.60 :: 1 : x & & \frac{12.60 \times 1}{.60} = 21 \text{ gal.} & \text{Ans.} & \text{Or,} \end{array}$$

$$\begin{array}{ccccccc} \text{cts.} & & & \text{cts.} & & \text{gal.} & \text{gal.} \\ 60 \text{ sell'g price} : 80 \text{ buy'g price} :: 63 \text{ original quan.} : x \text{ mix.} \end{array}$$

$$\begin{array}{r} 4 \quad 21 \\ 80 \times 63 = 84 \text{ gal.} = \text{mixture;} \\ \hline 60 \quad 84 - 63 = 21 \text{ gal. water.} \text{ Ans.} \\ 3 \end{array}$$

(54)

$$\$1 : \$3570 :: \$.60 : x = 3570 \times .60 = \$2142.00, \text{ A's share ;}$$

$$\$1 : \$1875 :: \$.60 : x = 1875 \times .60 = \$1125.00, \text{ B's share.}$$

(55)

$$\$3726 : \$1 :: \$2328.75 : x = \$.62\frac{1}{2} \quad \frac{2328.75}{3726} = \$.62\frac{1}{2} \text{ Ans.}$$

(56)

$$\begin{array}{ccccccc} \text{da.} & \text{da.} & & \text{bottles.} & & \text{bottles.} & \\ 30 \times 3 : 7 :: 80 : x = 6\frac{2}{3} & & \frac{7 \times 80}{90} = \frac{56}{9} = 6\frac{2}{3} \text{ bottles.} & \text{Ans.} \end{array}$$

(57)

$$4\frac{1}{2} = \frac{32}{7} : 40\frac{1}{2} = \frac{204}{7} :: 14 \quad 8 = 176 : x = \$15.86\frac{2}{3}$$

$$\begin{array}{r} 17 \quad 22 \\ 204 \times \frac{176}{1} \times \frac{7}{33} \times \frac{1}{96} = \frac{238}{15} = \$15.86\frac{2}{3} \text{ Ans.} \\ 5 \quad 3 \quad 8 \end{array}$$

(58)

$$\begin{array}{c} \text{oz.} \\ 14\frac{3}{4} : 154\frac{7}{8} \times 16 :: 1 : x = 168 \text{ lb.} \end{array}$$

$$\frac{21}{1239} \times \frac{2}{16} \times \frac{4}{59} = 168 \text{ lb. Ans.}$$

(59)

$$\begin{array}{c} \text{gal.} \quad \text{gal.} \quad \text{pt.} \\ 1 : 100 :: 1\frac{5}{2} : x = 93\frac{3}{4} \text{ gal.} \end{array}$$

$$\frac{50}{100} \times \frac{15}{2} = 750 \text{ pt.} = 93\frac{3}{4} \text{ gal. Ans.}$$

(60)

23-19=4 miles gain and 96 to be gained.

$$\begin{array}{c} \text{mi.} \quad \text{mi.} \quad \text{mi.} \\ 4 : 96 :: 23 : x = 552 \text{ miles.} \end{array} \quad \frac{96 \times 23}{4} = 552 \text{ miles. Ans.}$$

(61)

$$\begin{array}{c} \text{mins.} \quad \text{mins.} \\ \frac{3}{4} \text{ of } \frac{5}{7} = 1\frac{5}{8} : 1 :: \$9345 : x = \$17444 \end{array}$$

$$\frac{623}{9345} \times \frac{28}{16} = \$17444 \text{ Ans.}$$

(62)

The minute hand goes 12 times as fast as the hour hand: hence it gains 11 minute spaces while the hour hand moves over one. At six, the hour hand is 30 spaces ahead: how far does it move before it is overtaken?

$$\begin{array}{c} \text{spaces.} \quad \text{spaces.} \quad \text{space.} \quad \text{spaces.} \\ 11 : 30 :: 1 : x = 30 \div 11 = 2\frac{8}{11} \text{ spaces;} \end{array}$$

Time 6 o'clock 32 minutes $43\frac{7}{11}$ seconds. Ans.

$$\begin{array}{ccc} n & n & n \\ 7 & 196 :: 5 : x = 140 \text{ ft.} \end{array} \quad (63) \quad \frac{28}{196 \times 5} = 140 \text{ ft. Ans.}$$

$$(64)$$

A does $\frac{1}{3}$ of the work in 1 day,
 B " $\frac{1}{4}$ " " 1 "
 C " $\frac{1}{6}$ " " 1 "

$$\frac{1}{3} + \frac{1}{4} + \frac{1}{6} = \frac{9}{12} = \frac{3}{4} = 1 \text{ day's work of all ;}$$

$$\begin{array}{ccc} \text{work.} & \text{work.} & \text{da.} \\ \frac{3}{4} : 1 :: 1 : x = 1\frac{1}{3} \text{ da.} & 1 \div \frac{3}{4} = \frac{4}{3} = 1\frac{1}{3} \text{ da.} & \text{Ans.} \end{array}$$

$$(65)$$

A does $\frac{1}{15}$ of the work in 1 day,
 A and C do $\frac{1}{3}$ " " 1 "
 $\frac{1}{3} - \frac{1}{15} = \frac{2}{15}$ = what C does in 1 day.

$$\begin{array}{ccc} \text{work.} & \text{work.} & \text{da.} \\ \frac{2}{15} : 1 :: 1 : x = 22\frac{1}{2} \text{ da.} & 1 \times \frac{15}{2} = 22\frac{1}{2} \text{ da.} & \text{Ans.} \end{array}$$

$$(66)$$

$$\begin{array}{ccc} \text{da.} & \text{da.} & \text{men.} \\ 40\frac{2}{3} : 15\frac{1}{2} :: 120 : x = 45 \text{ men.} \end{array}$$

$$\frac{61}{4} \times \frac{120}{1} \times \frac{3}{122} = 45 \text{ men Ans.}$$

$$(67)$$

1 colt = $\frac{3}{4}$ horse ;
 7 horses + 3 colts = $8\frac{3}{4}$ horses ;
 $8\frac{3}{4} : 3 :: 40 : x = 13\frac{7}{11}$
 $\frac{10}{40} \times 3 \times \frac{5}{44} = \frac{150}{11} = 13\frac{7}{11} \text{ da.}$
 11

(68)

$$\begin{array}{cccc} \text{hr.} & \text{hr.} & \text{da.} & \text{da.} \\ 12\frac{1}{2} : 10\frac{1}{2} :: 24 : x = 20\frac{1}{2} \end{array} \quad \frac{24}{2} \times \frac{12}{1} \times \frac{4}{49} = \frac{144}{7} = 20\frac{1}{2} \text{ Ans.}$$

(69)

$$\begin{array}{ccc} \text{rd.} & & \\ 15 : 4 :: 40 : x = 6\frac{2}{3} \text{ rd.} \end{array} \quad \frac{4 \times 40}{15} = \frac{32}{3} = 10\frac{2}{3} \text{ rd. Ans.}$$

(70)

$$\begin{array}{ccc} \text{hr.} & \text{hr.} & \text{da.} \\ 9 : 12 :: 10 : x = 13\frac{1}{3} \text{ da.} \end{array} \quad \frac{12 \times 10}{9} = \frac{40}{3} = 13\frac{1}{3} \text{ da. Ans.}$$

(71)

$$\begin{array}{ccc} \text{ml.} & \text{ml.} & \text{cwt.} \\ 20 : 36 :: 4\frac{1}{2} : x = 8\frac{1}{10} \text{ cwt.} \end{array} \quad \frac{36}{1} \times \frac{9}{2} \times \frac{1}{20} = \frac{81}{10} = 8\frac{1}{10} \text{ cwt.} = 81 \text{ lb. Ans.}$$

(72)

$$\begin{array}{ccc} \text{wks.} & \text{wks.} & \text{horses.} \\ 90 : 7\frac{1}{2} :: 72 : x = 6 \end{array} \quad \frac{15}{2} \times \frac{12}{1} \times \frac{1}{90} = 6 \text{ horses. Ans.}$$

(73)

From 12 o'clock Monday to 10 hr. 15 min. on Saturday is
4 da. 22 hr. 15 min.

$$\begin{array}{cccc} \text{da.} & \text{da.} & \text{hr.} & \text{min.} \\ 1 : 4 & 22 & 15 & :: 3 & 10 : x = 15 \text{ min. } 36\frac{7}{8} \text{ sec. gain;} \\ & & & \text{to which add the 10 minutes} = 25 \text{ min. } 36\frac{7}{8} \text{ sec.;} \end{array}$$

10 hr. 15 min.

25 min. 36 $\frac{7}{8}$ sec.10 hr. 40 min. 36 $\frac{7}{8}$ sec. Ans.

(74)

B travels $11\frac{1}{2}$ yards per minute, and gains upon A, $\frac{1}{3}$ of a yard;

$536 \div 2 = 268$ yards, the whole distance to be gained;

$\frac{1}{3} : 268 :: 11 : x = 8844$ yards that A must travel to
before overtaken by B;

$8844 \div 536 = 16\frac{1}{2}$ that he must travel around the wood.

DOUBLE RULE OF THREE.

(1)

$$125 : 243 :: \frac{75}{2} :: \frac{x}{18}$$

$$\frac{\overset{27}{243} \times \overset{3}{75} \times 2}{\underset{5}{125} \times \underset{2}{18}} = \frac{81}{5} = 16\frac{1}{5} \text{ da. Ans.}$$

(2)

$$5 : 15 :: \frac{400}{12} : \frac{x}{2} \quad \frac{15 \times 400 \times 12}{5 \times 2} = 7200 \text{ Ans.}$$

(3)

$$\frac{12}{8} : \frac{15}{10} :: 120 : x = 187\frac{1}{2}$$

$$\frac{\overset{5}{15} \times \overset{10}{10} \times \overset{5}{120}}{\underset{2}{8} \times \underset{2}{8}} = \frac{375}{2} = 187\frac{1}{2} \text{ Ans.}$$

(4)

$$\frac{6}{4} : \frac{12}{9} :: 16 : x = 72$$

$$\frac{\overset{2}{12} \times \overset{4}{9} \times \overset{4}{16}}{\underset{6}{4} \times \underset{4}{4}} = 72 \text{ Ans.}$$

(5)

$$60 : 30 :: 24 : 48 \quad \frac{10}{30} \times \frac{20}{24} \times \frac{40}{48} = 10 \text{ da. } Ans.$$

(6)

$$\begin{array}{r} 36 \left. \begin{array}{l} 8 \\ 4 \end{array} \right\} : 864 \left. \begin{array}{l} 6 \\ 3 \end{array} \right\} :: 82 : 48 \\ 24 \cdot 3 \quad 41 \\ \frac{864 \times 3 \times 3 \times 82 \times 4}{36 \times 8 \times 4 \times 48} = \frac{369}{4} = 92\frac{1}{4} \text{ da. } Ans. \\ \quad \quad \quad \begin{array}{cc} 4 & 2 \\ 2 & \end{array} \end{array}$$

(7)

$$\begin{array}{r} 80 \quad 30 \\ 3\frac{1}{2} : 12 :: 84 : x = 36 \\ 150 \quad 50 \end{array}$$

$$\begin{array}{r} 3 \quad 21 \\ \frac{30 \times 12 \times 50 \times 84}{80 \times 3\frac{1}{2} \times 150} = 336 \text{ } Ans. \\ \quad \quad \quad \begin{array}{c} 2 \\ 8 \end{array} \end{array}$$

(8)

$$\begin{array}{r} 6 \quad 9 \\ 1 : 12.5 :: 15.6 : x \quad \frac{9 \times 12.5 \times 15.6}{6 \times 1} = 292.5 \text{ gal. } Ans. \end{array}$$

(9)

$$14 : 494 :: \frac{12}{7} : \frac{x}{19} \quad \frac{7 \times 494 \times 12}{14 \times 19} = 156 \text{ tailors. } Ans.$$

(10)

$$\begin{array}{r} 3600 \quad x \\ 1 : 2 :: 35 : 45 \\ \quad \quad \quad 24 \quad 14 \end{array}$$

$$\begin{array}{r} 7 \quad 400 \\ \frac{35 \times 24 \times 2 \times 3600}{45 \times 14} = 9600 \text{ men. } Ans. \\ \quad \quad \quad \begin{array}{c} 7 \\ 9 \end{array} \end{array}$$

(11)

$$20 : 7 :: \frac{100}{30} : x$$

$$\frac{7 \times 30 \times 100}{20 \times 21} = 50 \text{ men. } Ans.$$

(12)

$$\frac{4800}{45} : \frac{3600}{34} :: 24 : x = 13\frac{1}{2}$$

$$\frac{\frac{3}{3600} \times 34 \times 24}{\frac{4}{4800} \times \frac{5}{45}} = \frac{68}{5} = 13\frac{1}{2} \text{ oz. } Ans.$$

(13)

$$\frac{12\frac{1}{2}}{1\frac{1}{4}} : \frac{15}{2\frac{1}{2}} :: 5000 : x$$

$$\frac{15}{1} \times \frac{5}{2} \times \frac{200}{1} \times \frac{2}{25} \times \frac{4}{7} = 8571\frac{1}{7} \text{ planks. } Ans.$$

(14)

$$\frac{9}{24} : \frac{18}{12} :: 3 : x; \frac{\frac{2}{18} \times 12 \times 3}{9 \times 24} = 3 \text{ hr. } Ans.$$

(15)

$$\frac{13}{7\frac{1}{2}} : \frac{20}{15\frac{1}{2}} :: 149.76 : x = 471.04$$

$$\frac{4}{20} \times \frac{46}{3} \times \frac{1.28}{149.76} \times \frac{1}{13} \times \frac{2}{15} = \$471.04 \text{ } Ans.$$

(16)

$$264 : 129\frac{1}{2} :: 12\frac{1}{2} : 10\frac{3}{4}$$

$$\frac{9}{5} \times \frac{25}{2} \times \frac{33}{5} \times \frac{1}{264} \times \frac{7}{72} = 3\frac{1}{4} \text{ da. Ans.}$$

(17)

$$\begin{array}{ccccccc} 30 & 50 & 120 & x & & & \\ \frac{2}{3} : 2 :: 3 : 9 & & & & & & \text{Yards.} \\ 1\frac{1}{3} & 1\frac{1}{2} & 12 & 15 & & & \text{In} \end{array}$$

$$\frac{50 \times 2 \times 1\frac{1}{2} \times 120 \times 3 \times 12}{30 \times \frac{2}{3} \times 1\frac{1}{3} \times 9 \times 15} = 180 \text{ men.}$$

(18)

$$15 : 9 :: \frac{175}{10} : \frac{80}{x}; \quad \frac{9 \times 175 \times 10}{15 \times 80} = 13\frac{1}{2} \text{ in. Ans.}$$

(19)

500 - 200 = 300 miles remaining;

$$200 : 300 :: \frac{8}{12} : \frac{x}{10}; \quad \frac{300 \times 8 \times 12}{200 \times 10} = 14\frac{4}{5} \text{ da. Ans}$$

(20)

1000 + 600 = increased garrison,

$$1600 : 1000 :: \frac{28}{18} : \frac{42}{x};$$

$$\frac{1000 \times 28 \times 18}{1600 \times 42} = 7\frac{1}{2} \text{ oz. Ans.}$$

(21)

$$\begin{array}{rcl}
 5 & 7 & \\
 2\frac{1}{2} : 3 & :: 45 : x=97\frac{1}{2} \\
 1\frac{1}{4} & 2\frac{1}{4} & \\
 4 & 9 & \\
 \frac{7 \times 3 \times 2\frac{1}{4} \times 45}{5 \times 2\frac{1}{2} \times 1\frac{1}{4}} = 97\frac{1}{2} \text{ lb. } \textit{Ans.}
 \end{array}$$

(22)

$$\begin{array}{rcl}
 20 & 40 & 5 & x \\
 24 : 16 & :: 16 : 7 \\
 50 & 60 & 14 & 10 \\
 40 & 50 & &
 \end{array}$$

hence we have

$$\frac{40 \times 16 \times 60 \times 50 \times 5 \times 16 \times 14}{20 \times 24 \times 50 \times 40 \times 7 \times 10} = 32 \text{ da. } \textit{Ans.}$$

(23)

$$50000 - 18000 = 32000 = \text{remainder};$$

$$18000 : 32000 :: \frac{12}{6} : x$$

$$\frac{32000 \times 12 \times 6}{18000 \times 4} = 32 \text{ horses. } \textit{Ans.}$$

(24)

$$\begin{array}{rcl}
 232\frac{1}{2} & 337\frac{1}{2} & 248 & 24 \\
 3\frac{2}{3} : 5\frac{2}{3} & :: 5\frac{1}{2} : 9 \\
 2\frac{1}{3} & 3\frac{1}{2} & 11 & x \\
 7 & 4 & &
 \end{array}$$

$$\frac{675 \times \frac{28}{5} \times \frac{7}{2} \times 4 \times \frac{248}{1} \times \frac{11}{2} \times \frac{11}{1}}{\frac{465}{2} \times \frac{11}{3} \times \frac{7}{3} \times \frac{7}{1} \times \frac{24}{1} \times \frac{9}{1}} = 132 \text{ da. } \textit{Ans.}$$

PARTNERSHIP.

(2)

$$7500 : 2500 :: 3000 : x = \$1000, A's ;$$

$$7500 : 3000 :: 3000 : x = \$1200, B's ;$$

$$7500 : 2000 :: 3000 : x = \$800, C's.$$

(3)

$$4200 : 3600 :: 2000 : x = \$1714.28\frac{1}{2}, A's ;$$

$$4200 : 600 :: 2000 : x = \$285.71\frac{1}{2}, B's.$$

(4)

Since \$80 is to be paid out of the profits for expenses, the net profits will be \$15920.

$$40000 : 10000 :: 15920 : x = \$3980; 3980 + 50 = \$4030, A's;$$

$$40000 : 10000 :: 15920 : x = \qquad \qquad \qquad \$3980, B's;$$

$$40000 : 10000 :: 15920 : x = \qquad \qquad \qquad \$3980, C's;$$

$$40000 : 10000 :: 15920 : x = \$3980; 3980 + 30 = \$4010, D's.$$

(5)

$$2200 : 500 :: 440 : x = 100, A's ;$$

$$2200 : 700 :: 440 : x = 140, B's ;$$

$$2200 : 1000 :: 440 : x = 200, C's.$$

(6)

$$18000 : 5000 :: 12000 : x = \$3333.33\frac{1}{3}, \text{ First ;}$$

$$18000 : 4500 :: 12000 : x = \$3000 \quad \text{Second ;}$$

$$18000 : 4500 :: 12000 : x = \$3000 \quad \text{Third ;}$$

$$18000 : 4000 :: 12000 : x = \$2666.66\frac{2}{3} \quad \text{Fourth.}$$

(7)

As each son was to have but one half as much as the mother, so the surviving son will have but one part, while the mother will have two parts of the legacy, or the son will have $\frac{1}{2}$ and the mother $\frac{2}{3}$ of \$4500.

$$3 : 1 : 4500 : x = \$1500, \text{ the son's share ;}$$

$$3 : 2 : 4500 : x = \$3000, \text{ the mother's share.}$$

(8)

$$\begin{aligned} \text{A's gain} + \text{B's} + \text{C's} &= \$4320.50 + 5245.75 + 3600.75 = \$13167 ; \\ \$15000 - \$13167 &= \$1833 = \text{D's gain.} \end{aligned}$$

Since each share of the gain is to the whole gain as each share of the stock is to the whole stock, we have

$$1833 : 15000 :: 5499 : \$45000, \text{ the whole capital.}$$

$$15000 : 4320.50 :: 45000 : x = \$12961.50, \text{ A's stock ;}$$

$$15000 : 5245.75 :: 45000 : x = \$15737.25, \text{ B's stock ;}$$

$$15000 : 3600.75 :: 45000 : x = \$10802.25, \text{ C's stock.}$$

$$\$15000 - 13167 = \$1833, \text{ D's gain.}$$

(9)

A owned $\frac{3}{12}$, B $\frac{4}{12}$, and C $\frac{5}{12}$ of the mill ; $4300 - 2500 =$
\$1800, the whole loss.

$$12 : 3 : 1800 : x = 450, \text{ A's share ;}$$

$$12 : 4 : 1800 : x = 600, \text{ B's loss ;}$$

$$12 : 5 : 1800 : x = 750, \text{ C's loss.}$$

(10)

$5 + 7 + 8 = 20$; then A must have $\frac{5}{20}$, B $\frac{7}{20}$, and C $\frac{8}{20}$ of \$16970.

$$20 : 5 : 16970 : x = \$4242.50, \text{ A's stock ;}$$

$$20 : 7 : 16970 : x = \$5939.50, \text{ B's stock ;}$$

$$20 : 8 : 16970 : x = \$6788, \text{ C's stock.}$$

C's stock, \$6788, is equal to the whole gain, and each must have the same part of the whole gain as of the whole stock.

$$20 : 5 :: 6788 : x = \$1697, \text{ A's gain ;}$$

$$20 : 7 :: 6788 : x = \$2375.80, \text{ B's gain ;}$$

$$20 : 8 :: 6788 : x = \$2715.20, \text{ C's gain.}$$

H

(11)

$$475.50 + 362.125 + 250.875 + 140 = \$1228.50$$

$$1228.50 : 475.50 :: 614.25 : x = \$237.75, \text{ A's ;}$$

$$1228.50 : 362.125 :: 614.25 : x = \$181.0625, \text{ B's ;}$$

$$1228.50 : 250.875 :: 614.25 : x = \$125.4375, \text{ C's ;}$$

$$1228.50 : 140 :: 614.25 : x = \$70, \text{ D's.}$$

(12)

$$\frac{3}{8}, \frac{4}{8}, \frac{1}{8}, \frac{7}{8} = \frac{27}{48}, \frac{20}{48}, \frac{15}{48}, \frac{21}{48}, \text{ which added, gives } \frac{83}{48}.$$

Then the four persons agreed to do 83 parts of the work, of which A would do 27, B 20, C 15, and D 21, and each must therefore receive like parts of the amount paid.

$$83 : 27 :: 270 : x = \$87.831 + \text{A's ;}$$

$$83 : 20 :: 270 : x = \$65.060 + \text{B's ;}$$

$$83 : 15 :: 270 : x = \$48.795 + \text{C's ;}$$

$$83 : 21 :: 270 : x = \$68.313 + \text{D's.}$$

(13)

$$18500 + 24650 = \$43150 ; 50000 - 43150 = \$6850 = \text{C's stock ;}$$

$$\frac{1}{8} \text{ of } 7360 = \$460 = \text{C's extra allowance ; } 7360 - 460 = \$6900, \\ \text{net gain to be divided.}$$

$$50000 : 18500 :: 6000 : x = \$2553, \text{ A's profit ;}$$

$$50000 : 24650 :: 6900 : x = \$3401.70, \text{ B's profit ;}$$

$$50000 : 6850 :: 6900 : x = \$945.30 ; 945.30 + 460 =$$

$$\$1405.30, \text{ C's profit.}$$

(14)

$$10500 + 16500 = \$27000, \text{ entire stock ;}$$

$29400 - 4750 = \$24650$, amount at the beginning of the new year, and of which each has the same part as he originally put into the concern ; hence,

$$27000 : 10500 :: 24650 : x = \$9586\frac{1}{2}, \text{ A's stock ;}$$

$$27000 : 16500 :: 24650 : x = \$15063\frac{1}{2}, \text{ B's stock.}$$

(15)

The fractions $\frac{1}{2}$, $\frac{3}{5}$, and $\frac{7}{10}$, reduced to their least common denominator, are $\frac{5}{10}$, $\frac{6}{10}$, and $\frac{7}{10}$; and hence, the sums are proportional to the whole numbers, 5, 6, and 7.

$5+6+7=18$, the smallest sum of proportional numbers.

But since the number which denotes each share is taken twice, eighteen denotes *twice* the number of shares; hence, the number of shares is denoted by 9.

Now, the sum of the 1st and 2d shares is 5, that of the 1st and 3d 6, and that of the 2d and 3d, 7; therefore, the second share is greater by 1 than the first, and the third, 1 greater than the second; hence, the shares, taken in order, differ from each other by 1; and since their sum is 9, 2, 3, and 4, denote the respective shares.

$$9 : 2 :: 4569 : x = \$1015.33\frac{1}{3}, \text{ the first ;}$$

$$9 : 3 :: 4569 : x = \$1523, \text{ the second ;}$$

$$9 : 4 :: 4569 : x = \$2030.66\frac{2}{3}, \text{ the third.}$$

(2)

$7 \times 3 = 21$	$90 : 21 :: 70.20 : x = \$16.38, \text{ A's ;}$
$9 \times 5 = 45$	$90 : 45 :: 70.20 : x = \$35.10, \text{ B's ;}$
$4 \times 6 = 24$	$90 : 24 :: 70.20 : x = \$18.72, \text{ C's.}$
<u>90</u>	

(3)

The profits of each partner are to each other in the compound ratio of each one's stock and time; hence,

$$3000 : 2100 :: 10000 : x$$

$$12 : 8$$

$$\frac{7 \times 125 \times 10000 \times 12}{3000 \times 8} = \$10500, \text{ B's capital} = \text{value of 1500 barrels of flour ;}$$

$$10500 \div 1500 = \$7, \text{ cost per barrel. Ans.}$$

(4)

<p>A had \$23000 for 2 months, and \$21200 for 10 mo.; hence,</p> $23000 \times 2 = 46000$ $21200 \times 10 = 212000$ $\underline{\hspace{1.5cm}} \$258000, \text{ A's ;}$	<p>B had \$13500 for 4 months, and \$3500 for 5 mo.; hence,</p> $13500 \times 4 = 54000$ $3500 \times 5 = 17500$ $\underline{\hspace{1.5cm}} \$71500, \text{ B's ;}$
--	--

258000

71500329500 : 258000 :: 8400 : $x = \$6577.23\frac{443}{659}$, A's ;329500 : 71500 :: 8400 : $x = \$1822.76\frac{116}{659}$, B's.

(5)

$4000 \times 12 = 48000$ $3000 \times 15 = 45000$ $5000 \times 8 = 40000$ $\underline{\hspace{1.5cm}} 133000$	$133000 : 48000 :: 798 : x = \$228, \text{ A's ;}$ $133000 : 45000 :: 798 : x = \$270, \text{ B's ;}$ $133000 : 40000 :: 798 : x = \$240, \text{ C's .}$
--	--

(6)

If C's gain is $\frac{1}{12}$ and E's $\frac{6}{12}$ of the whole, then D's must be $\frac{5}{12}$ of the whole; then E's share of the gain is to D's, as E's stock for the time it was in trade, is to D's stock for the time it was in trade, and the same for C's ; hence,

$\frac{6}{12} : \frac{5}{12} :: 756 \times 4 : x = 2520 ; 2520 \div 9 = \$280, \text{ D's stock ;}$
 $\frac{6}{12} : \frac{1}{12} :: 756 \times 4 : x = 504 ; 504 \div 3 = \$168, \text{ C's stock .}$

(7)

3000 \times 9 = 270004000 \times 9 = 36000

63000, A's.

4000 \times 12 = 480004500 \times 3 = 135002500 \times 3 = 7500

69000, B's.

\$7333\frac{1}{3} \times 6 = 44000, C's.

176000

176000 : 63000 :: 7400 : $x = \$2648.86\frac{4}{11}$, A's ;176000 : 69000 :: 7400 : $x = \$2901.13\frac{7}{11}$, B's ;176000 : 44000 :: 7400 : $x = \$1850.$, C's.

(8)

If \$600 accrue from \$480 in six months, the gain, \$120, would be equal to $\frac{1}{4}$ the stock, and in 12 months it would be twice as much, or $\frac{1}{2}$ the stock; therefore, \$1200, B's stock and gain for 12 months, is $\frac{3}{2}$ of his stock, from which we obtain \$800 for B's stock.

Then B's stock is to C's stock, as B's gain for 12 months is to C's gain for the same time; or,

800 : 320 :: 400 : $x = \$160$, C's gain for 12 months.

\$520 - \$320 = \$200, C's whole gain.

160, gain for 12 mo. : 200 entire gain :: 12 mo. : $x =$
15 mo., C's time.

PERCENTAGE.

.05; .08; .15 $\frac{1}{2}$ or .155; 1.00; 2.04; 3.27 $\frac{1}{2}$; 6.723;
.49; 5.075.

(1)

1256 \times .04 = \$50.24 *Ans.*

(2)

956.50 \times .12 = \$114.78 *Ans.*

(3)

475 \times .00 $\frac{1}{4}$ = 1.1875 yd. *Ans.*

(4)

324.5 \times .00 $\frac{7}{8}$ = 2.839375 cwt.

(5)

125.25 \times .00 $\frac{4}{5}$ = 1.0020 lb. *A.*

(6)

750 \times .016 = 12 bu. *Ans.*

(7)

2000 \times .045 = \$90.00 *Ans.*

(8)

186 \times .09 = 16.74 mi. *Ans.*

(9)

460 \times .10375 = 47.725 sh *Ans.*

(10)

540 \times .051 = 27.54 T. *Ans.*

(11)

$$3465.75 \times .086\frac{2}{3} = \$300.365 \text{ A.}$$

(12)

$$126 \times .125 = 15.75 \text{ cows. A.}$$

(13)

$$320 \times .50 = 160 \text{ bales.}$$

(14)

$$1275 \times .375 = 478.125 \text{ yd.}$$

(15)

$$4573 \times .95 = \$4344.35. \text{ A.}$$

(16)

$$2500 \times 1.05 = 2625 \text{ bbl. Ans.}$$

(17)

$$4537 \times 1.25 = \$5144.625. \text{ A}$$

(18)

$$5000 \times 2.50 = \$12500$$

(19)

$$1267.875 \times 3.05 = \$3867.01875.$$

(20)

$$3000 \times 5.00 = \$15000 \text{ A.}$$

(21)

$$765 \times .03 = \$22.95 \text{ Ans.}$$

(22)

$$960 \times .04\frac{1}{2} = \$43.20 \text{ Ans.}$$

(23)

$$1500 \times .075 = 112.50$$

$$1000 \times .0475 = 47.50$$

$$\underline{\$65.00}$$

(24)

$$895 \times .17 = 152.15 ; 895 - 152.15 = 742.85 \text{ gallons. Ans.}$$

(25)

$$250 \times .18 = 45. ; 250 - 45 = 205 \text{ boxes. Ans.}$$

(1)

$$2 \div 10 = .20 \text{ Ans.}$$

(2)

$$4 \div 32 = .125 \text{ Ans.}$$

(3)

$$3 \div 40 = .075 \text{ A.}$$

(4)

$$17 \div 125 = .136 \text{ A.}$$

(5)

$$36 \div 144 = .25 \text{ A.}$$

(6)

$$84 \div 96 = .875 \text{ A.}$$

$$(7) \quad \frac{1}{2} \div \frac{7}{8} = .57\frac{1}{7} \text{ Ans.}$$

$$(8) \quad 3 \div 400 = .00\frac{3}{4} \text{ Ans.}$$

$$(9) \quad 4\frac{1}{2} \div 9\frac{1}{2} = .47\frac{7}{8}$$

$$(10) \quad 104 \div 312 = .33\frac{1}{3}$$

$$(11) \quad 121.87\frac{1}{2} \div 325 = .37\frac{1}{2}$$

$$(12) \quad 56\frac{1}{4} \div 450 = .12\frac{1}{2}$$

$$(13) \quad \frac{7}{8} \text{ No.} = .87\frac{1}{2} \text{ No.}$$

$$(14) \quad \frac{4}{5} \text{ ship} = .80 \text{ ship}$$

$$(15) \quad \frac{7}{10} \text{ of } 50 = .70 \text{ of } 50$$

$$(16) \quad \frac{2}{3} \text{ cargo} = 66\frac{2}{3}\% \text{ cargo. Ans.}$$

$$(17) \quad 1\frac{1}{2} \text{ No.} = 1.60 \text{ or } 160\% \text{ No.}$$

$$(2) \quad 475 \div .25 = 1900 \text{ Ans.}$$

$$(3) \quad 87\frac{1}{2} \div .125 = 700 \text{ Ans.}$$

$$(4) \quad 560 \div 1.40 = \$400 \text{ Ans.}$$

$$(5) \quad 75 \div .005 = 15000 \text{ Ans.}$$

$$(6) \quad 1.25 \div .00875 = 142.857\frac{1}{7} \text{ Ans.}$$

$$(7) \quad \frac{7}{8} \div .45 = 1.94\frac{4}{5} \text{ Ans.}$$

$$(8) \quad \frac{3}{4} \div .00\frac{5}{8} = \frac{3}{4} \div \frac{5}{8} \text{ of } \frac{1}{160} = \frac{3}{4} \times \frac{120}{1} = 90 \text{ Ans.}$$

$$(9) \quad 5850 \div .75 = \$7800 \text{ Ans.}$$

$$(10) \quad 1647 \div .375 = \$4392 \text{ Ans.}$$

$$(11) \quad 1.00 - .25 = .75 = \text{number of men unhurt;} \\ 1560 \div .75 = 20800 \text{ men. Ans.}$$

$$(1) \quad 392 \div 1.01 = 388.1188 + \text{Ans.}$$

$$(2) \quad 10350 \div 1.15 = 9000 \text{ Ans.}$$

(3)

$$.1078 \div 1.96 = 550 \text{ sheep } \textit{Ans.}$$

(4)

$$1008 \div 1.33\frac{1}{3} = \$756 \text{ } \textit{Ans.}$$

(5)

$$122 \div 4.05 = \$30.123 + \textit{Ans.}$$

(6)

$$1036 \div 1.40 = \$740 \text{ } \textit{Ans.}$$

(7)

$$85000 \div 2.25 = \$37777.77\frac{7}{8} \text{ } \textit{A.}$$

(8)

$$9180 \div 1.70 = \$5400 \text{ } \textit{Ans.}$$

(9)

$$248 \div 1.55 = \$160 = \text{cost of sheep} ; 160 \div 40 = \$4, \text{ price per hd.}$$

(10)

$$6835.50 \div 1.26 = \$5425 \text{ } \textit{Ans.}$$

(1)

$$136 \div .85 = 160 \text{ marbles. } \textit{A.}$$

(2)

$$615 \div .82 = 750 \text{ sheep. } \textit{Ans.}$$

(3)

$$513 \div .54 = \$950 \text{ } \textit{Ans.}$$

(4)

$$.20 + .15 = .35 \text{ lost} ; 1 - .35 = .65 \text{ remainder} ; \\ 19500 \div .65 = 30000 \text{ men. } \textit{Ans.}$$

(5)

$$10935 \div .81 = \$13500 \text{ } \textit{Ans.}$$

(6)

$$31250 \div .62\frac{1}{2} = \$50000 \text{ } \textit{Ans.}$$

(7)

$$4200 \div .84 = \$5000 \text{ } \textit{Ans.}$$

(8)

$$2262 \div .87 = \$2600 \text{ } \textit{Ans.}$$

PROFIT AND LOSS.

(1)

$.07 \times 250 \times 9 = \157.50 cost ; $.07 \times 250 \times 9 = \191.25 selling price ; $191.25 - 157.50 = \$33.75$ gain. *Ans.*

(2)

$.31\frac{1}{4} - 27 = .04\frac{1}{4}$ gain per yd. ; $.04\frac{1}{4} \times 43 \times 15 = \$27.41\frac{1}{4}$

(3)

$360 \times .75 = \$270$ cost of keeping ; $1.25 \times 360 = \$450$, value of wool ; $.62\frac{1}{2} \times 90 = \56.25 , value of lambs ;
 $(450 + 56.25) - 270 = \$236.25$ gain. *Ans.*

(4)

$5\frac{1}{2} \times 65 = \357.50 , cost of flour ; $357.50 + 42.50 = \$400$ price ; $400 \div 65 = \$6.15\frac{5}{13}$, price per bbl. *Ans.*

(5)

$.62\frac{1}{2} \times 500 = \312.50 , cost ; $312.50 + 35 = \$347.50$, selling price ; $347.50 \div 500 = \$6.95$, price per bu. *Ans.*

(6)

$6450 + 575 + 796 = \$7821$, entire cost ; $7821 + 945 = \$8766$, price. *Ans.*

(7)

After one-third leaked out, 2 hhd. remained, equal to 126 gal.
 $68.04 + 2.52 = \$70.56$, what the remainder must sell for.
 $70.56 \div 126 = .56$ cts. per gallon.

(8)

$4162.50 \times .22 = \$915.75$ *Ans.*

H*

(9)

$$(3612 + 54) \times .20 = \$733.20$$

(10)

$$37649 \times .31\frac{1}{2} = \$11765.31\frac{1}{2}$$

(11)

$$2965 \times .15 = \$444.75 \text{ Ans.}$$

(12)

$$\begin{aligned} \frac{1}{10} \text{ of } 8550 &= 855; 855 \times .12 = \$102.60, \text{ loss on } \frac{1}{10} \text{ of flour;} \\ \frac{1}{4} \text{ of } 8550 &= 2137\frac{1}{2}; 2137.50 \times .19 = \$406.125, \text{ gain on } \frac{1}{4}; \\ \frac{1}{10} + \frac{1}{4} &= \frac{4}{40} + \frac{10}{40} = \frac{14}{40}; 1 - \frac{14}{40} = \frac{26}{40} = \frac{13}{20}, \text{ remainder;} \\ \frac{13}{20} \text{ of } 8550 &= 5557.50; 5557.50 \times .30 = \$1667.25, \text{ gain on rem.;} \\ 406.125 + 1667.25 &= \$2073.375, \text{ entire gain;} 2073.375 - \\ &102.60 = \$1970.775 \text{ Ans.} \end{aligned}$$

(13)

$$\$16 \times .12\frac{1}{2} = \$0.02 \text{ Ans.}$$

(14)

$$200000 \times .08 = \$16000.00; 16000 + 2860 = \$18860, \text{ entire profit. Ans.}$$

(15)

$$5\% \text{ of } 25\% = \frac{\$}{100} \text{ of } \frac{25}{100} = \frac{1}{80} = 1\frac{1}{4}\% \text{ Ans.}$$

(16)

$$.75 \times 20 = \$0.15, \text{ gain;} .75 + .15 = \$0.90. \text{ Ans.}$$

(17)

$$1 \text{ pipe} = 126 \text{ gallons.}$$

$$\begin{aligned} 322.56 \times .25 &= \$70.64; 322.56 + 70.64 = \$393.20; \\ 393.20 \div 126 &= \$3.20 \text{ per gallon.} \end{aligned}$$

(18)

$$3493.33\frac{1}{3} \times .10 = \$349.333\frac{1}{3}; 3493.333\frac{1}{3} - 349.333\frac{1}{3} =$$

$$\$3144, \text{ price}; 3144 \div 3275 = \$0.96, \text{ price per bu. } \textit{Ans.}$$

(19)

$$150.25 \times .40 = \$60.10 \text{ gain}; 150.25 \times .28 = \$42.07 \text{ loss};$$

$$60.10 - 42.07 = \$18.03, \text{ balance of gain.}$$

(20)

$$144 - 36 = 108 \text{ gallons remains.}$$

$$144 \times .45 = \$64.80 \text{ cost}; 64.80 \times .10 = \$6.48 \text{ gain};$$

$$64.80 + 6.48 = \$71.28; 71.28 \div 108 = \$0.66 \text{ per gal.}$$

(21)

$$5 + 3 + 2 + 40 = 50 \text{ per cent. to be gained.}$$

$$3500 \times 120 = \$4200 \text{ cost}; 4200 \times .50 = \$2100 \text{ gain};$$

$$4200 + 2100 = \$6300; 6300 \div 3500 = \$1.80 \text{ per bushel.}$$

(22)

$$425 - 348.50 = \$76.50 \text{ whole gain}; 76.50 \div 425 =$$

$$.18, \text{ or } 18 \text{ per cent.}$$

(23)

$$.07\frac{1}{2} - .06 = .015 \text{ gain}; .015 \div .06 = .25 \text{ gain per cent.}$$

(24)

$$1.20 - .90 = .30; .30 \div .90 = .33\frac{1}{3} \text{ per cent. on the rye.}$$

$$1.50 - 1.12\frac{1}{2} = .37\frac{1}{2}; .375 \div 1.125 = .33\frac{1}{3} \quad \text{ " } \quad \text{on wheat.}$$

(25)

$$20 \times .18 = \$3.60, \text{ what it sold for per ream};$$

$$\$3.60 - \$2 = \$1.60, \text{ gain per ream};$$

$$1.60 \div 2 = .80, \text{ gain per cent.}$$

(26)

13 cwt. 3 qr. 14 lb. = 13.89 cwt., or 1389 pounds ;

 $13.89 \times 8 = \$111.12$, cost ; $1389 \times .10 = \$138.90$, what it sold for ; $138.90 - 111.12 = \$27.78$, whole gain ; $27.78 \div 111.12 = .25$, gain per cent.

(27)

45 T. 16 cwt. 25 lb. = 45.8125 tons ;

 $45.8125 \times 75 = \$3435.9375$, cost ; $45.8125 \times 78.50 =$ $\$3596.28125$, what it sold for ; $3596.28125 - \$3435.9375 = \160.34375 , whole gain ; $160.34375 \div 3435.9375 = .046 + = 4\frac{2}{3}\%$ gain.

(28)

 $7000 + 425 = \$7425$, cost of lumber ;Of material there was lost $\frac{216}{1000}$ of 67560 = $2084\frac{1}{4}$ ft. ; $67560 - 2084\frac{1}{4} = 65475\frac{5}{8}$, remainder ; $(65475\frac{5}{8} \div 1000) \times 97.50 = \$6383.840\frac{3}{8}$, price of lumber ; $7425 - 6383.840\frac{3}{8} = \$1041.15908\frac{1}{8}$

(29)

 $593.75 - 475 = \$118.75$, amount of premium on gold, or of discount on paper ; $118.75 \div 475 = .25$, or 25% premium on gold ; $118.75 \div 593.75 = .20$, or 20% discount on paper.

(30)

\$500 is 31% of what number ? $500 \div 31 = \$1612.90\frac{1}{3}$ A.

(31)

 $3745 \div .25 = \$14980$ Ans.

(32)

 $2965 + 1260 = \$4225$, total profit ; $4225 \div .40 = 10562.50$

(33)

 $4500 + 2500 = \$7000$, total profit ; $7000 \div 35 = \$20000$, total sales. *Ans.*

(34)

 $82500 \div .12\frac{1}{2} = \260000 *Ans.*

(35)

$$10\% \text{ of } 12\% \text{ of capital} = \frac{10}{100} \text{ of } \frac{12}{100} = \frac{3}{250} = .012 =$$

$$1\frac{1}{8}\% \text{ capital. } \textit{Ans.}$$

(36)

 $477.12 \div 1.12 = \$426$ *Ans.*

(37)

 $340 \div 85 = \$400$ *Ans.*

(38)

 $195.50 \div 1.15 = \$170$ *Ans.*

(39)

 $78 \text{ cwt. } 3 \text{ qr. } 14 \text{ lb.} = 7889 \text{ lb. ; } 7889 \times .08 = \$631.12 ;$ $631.12 \div 1.15 = \$548.80$ *Ans.*

(40)

 $472.50 \div 1.35 = \$350$, value of one ; $472.50 \div .90 = \$525$, value of other ; $472.50 \times 2 = \$945$, price of both ; $350 + 525 = \$875$, cost of both ; $945 - 875 = \$70$ gain. *Ans.*

(41)

 $7 \div 87\frac{1}{2} = \$8$, asking price ; $8 \div 1.33\frac{1}{3} = \6 cost. *Ans.*

(42)

$$3850 \div .88 = \$4375 \text{ Ans.}$$

(43)

$$10 \div 1.25 = \$8, \text{ cost ; } 11.60 - 8 = \$3.60, \text{ whole gain ; } \\ 3.60 \div 8 = .45 = 45\% \text{ gain. Ans.}$$

(44)

$$25650 \times 19.20 \div 1000 = \$492.48 ; 492.48 \div 1.20 = \$410.40 \text{ cost ; } \\ 25650 \times 15 \div 1000 = \$384.75 ; 410.40 - 384.75 = \$25.65 \text{ loss.}$$

(45)

$$3881.25 \div 1.125 = \$3450 \text{ cost ; } \\ 3450 - 3277.50 = \$172.50, \text{ whole loss ; } \\ 172.50 \div 34.50 = .05 = 5\% \text{ loss. Ans.}$$

(46)

$$.66 = 1.20 = .55 \text{ cost ; } .77 - .55 = .22 \text{ gain on 1 lb ; } \\ .22 \div .55 = .40 = 40\% \text{ gain. Ans.}$$

(47)

$$5520 \times .50 = \$2760, \text{ what the corn sold for ; } \\ 2760 \div .92 = \$3000, \text{ what it cost ; } \\ 5520 \times .60 = \$3312 ; 3312 - 3000 = \$312, \text{ whole gain ; } \\ 312 \div 3000 = 10\frac{2}{3} = 10\frac{2}{3}\% \text{ gain. Ans.}$$

(48)

$$1412\frac{1}{2} \times 3 \times .11 = \$466.125 ; 466.125 \div 1.375 = \$339 \text{ cost. } \\ 339 \times .50 = \$169.50 \text{ gain ; } 339 + 169.50 = \$508.50 \text{ Ans.}$$

COMMISSION.

(1)

$$7540 \times .025 = \$188.50 \text{ commission ;}$$

$$7540 - 188.50 = \$7351.50 \text{ paid over.}$$

(2)

$$1399.77 \div 1.03 = \$1359 \text{ purchase ;}$$

$$1359 \times .03 = \$40.77 \text{ commission.}$$

(3)

$$(3125 + 1520) \times .0075 = \$34.8375 \text{ Ans.}$$

(4)

$$9.75 \times 750 \times .0225 = \$164.53125 \text{ Ana}$$

(5)

$$6.50 \times 9.50 \times 96 = \$5928 \text{ cost ; } 5928 \times .01625 = \$96.33 \text{ com. ;}$$

$$5928 - 96.33 = \$5831.67 \text{ Ans.}$$

(6)

$$2\frac{3}{4} + 1\frac{1}{4} = 4 \text{ per cent. commission ;}$$

$$2340 \times 1.75 = \$4095, \text{ first cost of the wheat ;}$$

$$4095 \times .04 = \$163.80, \text{ his commission ;}$$

$$4095 \times .06 = \$245.70, \text{ commission and freight ;}$$

$$\$4095 + \$245.70 = \$4340.70, \text{ entire cost of the wheat.}$$

(7)

$$2564.25 \times .045 = \$115.39 + \text{ Ans.}$$

(8)

$$7320.25 \times .06625 = \$484.9665 ;$$

$$7320.25 - 484.9665 = 6835.283 \text{ Ans.}$$

(9)

$$1000 \times .065 = \$65; 1000 - 65 = 935. \text{ Ans.}$$

(10)

$$3476 \times .12\frac{1}{2} = \$434.50, \text{ the whole amount;} \\ 434.50 \times .03\frac{1}{2} = 13.578; 434.50 - 13.578 = \$420.922 \text{ Ans.}$$

(11)

$$1500 \times .025 = 37.50$$

$$1000 \times .0325 = \underline{32.50}$$

\$70 amount of loss.

(12)

$$2640 \times .02\frac{3}{4} = \$68.64 \text{ discount;} 2640 - 68.64 = \$2571.36$$

(13)

$$4.75 \times 275 = \$1306.25 \text{ cost;} 20\% + \frac{1}{4}\% + \frac{3}{4}\% = 3\%; \\ 1306.25 \times .03 = \$39.1875 \text{ charges;} \\ 1306.25 = 39.1875 = \$1267.0625 \text{ transmitted.}$$

(14)

$$12000 \div 1.02 = \$11764.705 + \text{purchase;} \\ 12000 - 11764.705 = \$235.295 + \text{commission.}$$

(15)

$$708.75 \div 1.05 = \$675 \text{ purchase money;} 675 \div 45 = 15 \text{ tons}$$

(16)

$$2608.625 \div 1.025 = \$2545 \text{ purchase money;} \\ 2608.625 - 2545 = \$63.625 \text{ commission;} \\ 2545 \div .56 = 4544.642 + \text{bushels. Ans.}$$

(17)

$$\begin{aligned}
 42.66 &= .018 = \$2370 \text{ purchase money ;} \\
 240 \times .06\frac{1}{2} &= \$15, \text{ cost of one barrel ;} \\
 2370 \div 15 &= 158 \text{ barrels ;} \\
 2370 + 42.60 &= \$2412.66, \text{ whole amount.}
 \end{aligned}$$

(18)

$$\begin{aligned}
 .02 + .00\frac{1}{8} + .00\frac{1}{8} + .00\frac{1}{10} &= .02\frac{17}{100}, \text{ sum of allowances ;} \\
 187.50 \div 1.02\frac{17}{100} &= \$183.0607 + \text{sum expended in cotton ;} \\
 183.0607 \times .02 &= \$3.6612 + \text{commission.}
 \end{aligned}$$

(19)

$$60 \div 2785 = .02\frac{36}{887}, \text{ or } 2\frac{36}{887}\%$$

(20)

$$175 \div 6795 = .02\frac{782}{1335}$$

(21)

$$15 \div 175 = .08\frac{4}{7}, \text{ or } 8\frac{4}{7}\% \text{ A.}$$

(22)

$$5 \div 45 = .11\frac{1}{3}, \text{ or } 11\frac{1}{3}\% \text{ A.}$$

INTEREST.

(1)

$$675 \times .06\frac{1}{2} = \$43.875 \text{ Ans.}$$

(2)

$$871.25 \times .07 = \$60.9875 \text{ A.}$$

(3)

$$535.50 \times .06 \times 7 = \$224.91 \text{ Ans.}$$

(4)

$$1125.885 \times .08 \times 4 = \$360.2832 \text{ Ans.}$$

(5)

$$789.74 \times .05 \times 12 = \$473.844 \text{ Ans.}$$

(6)

$$2500 \times .07\frac{1}{2} \times 7 = \$1312.50 \text{ Ans.}$$

(7)

$$3153.82 \times .04\frac{1}{2} \times 2 = \$283.8438 \text{ Ans.}$$

(8)

$$199.48 \times .07 \times 16 = \$223.4176 ;$$

$$223.4176 + 199.48 = \$422.8976 \text{ Ans.}$$

(9)

$$897.50 \times .08 \times 3 = \$215.40 ; 215.40 + 897.50 = \$1112.90$$

(10)

$$982.35 \times .06\frac{1}{4} \times 4 = \$265.2345 \text{ Ans.}$$

(11)

$$1500 \times .05\frac{1}{4} \times 5 = \$393.75 ; 393.75 + 1500.00 = 1893.75$$

(12)

$$1914.10 \times .03\frac{1}{4} \times 6 = \$373.2495 \text{ Ans.}$$

(13)

$$350 \times .10 \times 21 = \$735.00 \text{ Ans.}$$

(14)

$$628.50 \times .12\frac{1}{2} \times 5 = \$387.575 ; 387.575 + 628.50 = \$1016.075$$

(15)

$$75.50 \times .06 \times 10 = \$45.30 ; 45.30 + 75.50 = \$120.80 \text{ Ans}$$

(16)

$$5040 \times .07\frac{1}{2} \times 2 = \$756 ; 5040 + 756 = \$5796 \text{ Ans.}$$

(17)

$$119.48 \times .07 \times 2\frac{1}{2} = \$20.909.$$

(18)

$$250.60 \times .06 \times 1\frac{1}{4} = \$26.313$$

(19)

$$956 \times .09 \times 5\frac{1}{2} = \$458.88 \text{ Ans.}$$

(20)

$$1575.20 \times .07 \times 3\frac{3}{4} = \$404.3013 ;$$

$$404.3013 + 1575.20 = \$1979.5013 \text{ Ans.}$$

(21)

$$5.000 \times .05\frac{1}{2} \times 2\frac{1}{4} = \$618.75 ; 618.75 + 5000 = \$5618.75$$

(22)

$$1508.20 \times .10 \times 4\frac{1}{8} = \$628.416\frac{2}{3} \text{ Ans.}$$

(23)

$$75 \times .12\frac{1}{2} \times 6\frac{5}{8} = \$64.0625 \text{ Ans.}$$

(24)

$$125 \times .04\frac{1}{4} \times 5\frac{1}{2} = \$32.65625 ; 32.65625 + 125 = \$157.65625$$

(2)

$$1 \text{ yr. } 8 \text{ mo. } 6 \text{ da.} = 20.2 \text{ mo. ;}$$

$$358.50 \times .07 = \$25.0950, \text{ interest of 1 year ;}$$

$$25.0950 \div 12 = 2.09125, \text{ interest of 1 month ;}$$

$$2.09125 \times 20.2 = \$42.24325 \text{ Ans.}$$

(3)

$$4 \text{ yr. } 9 \text{ mo. } 15 \text{ da.} = 57.5 \text{ months ;}$$

$$1461.75 \times .06 = \$87.705, \text{ interest of 1 year ;}$$

$$87.705 \div 12 = 7.30875, \text{ interest of 1 month ;}$$

$$7.30875 \times 57.5 = \$420.253125 \text{ Ans.}$$

(4)

$$(1200 \times .07\frac{1}{2} \div 12) \times 28.4 = \$213 \text{ Ans.}$$

(5)

$$(4500 \times .05 \div 12) \times 9.6\frac{2}{3} = \$181.25 \text{ Ans.}$$

(6)

$$(156.25 \times .08 \div 12) \times 10.6 = \$11.0415 \text{ Ans.}$$

(7)

$$(640 \times .06\frac{1}{2} \div 12) \times 38.3 = \$132.7707 \text{ Ans.}$$

(8)

$$(27650 \times .10 \div 12) \times 11.7 = \$26.9586 + \text{Ans.}$$

(9)

$$(378.42 \times .07 \div 12) \times 17.1 = \$37.747395 ;$$

$$37.747395 + 378.42 = \$416.167395 \text{ Ans.}$$

(10)

$$(1250 \times .10\frac{1}{4} \div 12) \times 7.7 = \$84.21875, \text{ interest ;}$$

$$84.21875 + 1250 = \$1334.21875 \text{ Ans.}$$

(11)

$$(6500 \times .09\frac{1}{2} \div 12) \times 2.3\frac{1}{3} = \$120.0693 \text{ Ans.}$$

(12)

$$(70.50 \times .05\frac{1}{4} \div 12) \times 130 = \$40.0968 \text{ Ans.}$$

(13)

$$(45 \times .06\frac{3}{4} \div 12) \times 144.9 = \$36.6778 + \text{interest ;}$$

$$36.6778 + 45 = \$81.6778 + \text{Ans.}$$

(14)

$$100 \times .04 \div 12) \times 186 = \$62, \text{ interest ; } 62 + 100 = \$162$$

(15)

$$(475.50 \times .08 \div 12) \times 69.8 = \$221.266 \text{ Ans.}$$

(16)

$$(4560 \times .07 \div 12) \times 14.6\frac{1}{2} = \$389.2466 \text{ Ans.}$$

(17)

$$(128.375 \times .06 \div 12) \times 10.9 = \$6.9964 + \text{interest};$$
$$6.9964 + 128.375 = \$135.3714 + \text{Ans.}$$

(18)

$$(264.52 \times .06 \div 12) \times 32.4\frac{1}{2} = \$42.9404 \text{ Ans.}$$

(19)

$$(76.50 \times .06 \div 12) \times 21.4 = \$8.1855, \text{ interest};$$
$$8.1855 + 76.50 = \$84.6855 \text{ Ans.}$$

(20)

$$(241.60 \times .07 \div 12) \times 39.5 = \$55.6685 + \text{Ans.}$$

(21)

$$(5600 \times .07 \div 12) \times 1 = \$32.666\frac{2}{3} \text{ Ans.}$$

(22)

$$(8450 \times .10 \div 12) \times 2 = \$140.8333\frac{1}{3}, \text{ interest};$$
$$140.8333\frac{1}{3} + 8450 = \$8590.8333\frac{1}{3} \text{ Ans.}$$

(23)

$$(4000 \times .09 \div 12) \times 1.2 = \$36.00 \text{ Ans.}$$

(24)

yr.	mo.	da.
1853	10	10
1852	9	9

 1 1 1, time.

$$(87.60 \times .06\frac{1}{2} \div 12) \times 13.0\frac{1}{2} = \$6.18431 + ;$$

$$6.18431 + 87.60 = \$93.78431 + \text{Ans.}$$

(25)

yr.	mo.	da.
1858	4	25
1854	7	8

 3 9 17, time.

$$(126.75 \times .07 \div 12) \times 45.5\frac{2}{3} = \$33.69085 + ;$$

$$33.69085 + 126.75 = \$160.44085 + \text{Ans.}$$

(26)

yr.	mo.	da.
1856	9	15
1856	1	1

 8 14

$$(350 \times .05\frac{1}{4} \div 12) \times 8.4\frac{2}{3} = \$12.96358 + \text{Ans.}$$

(27)

yr.	mo.	da.
1856	12	1
1855	3	14

 1 8 17

Time, less 90 days = $17.5\frac{2}{3}$ mo.;

$$(560.40 \times .10 \div 12) \times 17.5\frac{2}{3} = \$82.036\frac{1}{3} \text{ Ans.}$$

(28)

$$(1256 \times .06 \div 12) \times 11.3 = \$70964 \text{ Ans.}$$

(29)

yr.	mo.	da.
1854	5	10
1850	10	5
<hr/>		
3	7	5

$$(745.40 \times .05 \div 12) \times 43.1\frac{1}{2} = \$134.06703 + ;$$

$$134.06703 + 745.40 = \$879.46703 + \text{Ans.}$$

(30)

1st time, 1 yr. 3 mo. 21 da. ; 2d, 9 mo. 27 da.

$$(250 \times .07 \div 12) \times 15.7 = \$22.89531 ;$$

$$22.89531 + 250 = \$272.89531 ;$$

$$(500 \times .07 \div 12) \times 9.9 = \$28.87434 ;$$

$$28.87434 + 500 = \$528.87434 ;$$

$$272.895 + 528.874 = \$801.769 + \text{Ans.}$$

(31)

From January 1st to September 1st	= 8 mo.
" March 15th	" = 5 mo. 16 da
" April 20th	" = 4 mo. 11 da.
" June 3d	" = 1 mo. 28 da.

Amount of \$254	for 8 mo.	= \$264.16
" \$154.60	" 5 mo. 16 da.	= \$158.8772 +
" \$424.25	" 4 mo. 11 da.	= \$433.5127 +
" \$75.50	" 2 mo. 28 da.	= \$76.6073 +
		<u>\$933.1573 A.</u>

(32)

$$\$475.75 \times .07 \div 12 = 2.7752 ; 2.7752 \times 8.5 = \$499.339 \text{ A.}$$

(33)

$$\$127.28 \times .06 \div 12 = .6364 ; .6364 \times 21 + 127.68 = 140.644$$

(34)

At the end of the first year \$1500 must be paid, and the interest on \$4500, equal to. . . . \$1792.50

At the end of the second year \$1500, and interest on \$3000 = \$1695.00

At the end of the third year \$15000, and interest on \$1500 = \$1597.50

Amount, \$5085.00 *A*

(35)

Interest on \$40 for 8 months . . . \$1.86 $\frac{2}{3}$

" " \$40 " 7 " . . . 1.63 $\frac{1}{3}$

" " \$40 " 6 " . . . 1.40

" " \$40 " 5 " . . . 1.16 $\frac{2}{3}$

" " \$40 " 4 "93 $\frac{1}{3}$

" " \$40 " 3 "70

" " \$40 " 2 "46 $\frac{2}{3}$

" " \$40 " 1 "23 $\frac{1}{3}$

Interest due at end of time . . . \$8.40

Add principal due . . . 360.00

Amount due . . . \$368.40

Interest on \$368.40 for 1 yr. 4 mo. 15 da. = \$35.458 ;

\$368.40 + 35.458 = \$403.858. *Ans.*

(36)

\$9000 \div 3 = \$3000 ;

Amount of \$3000 for 6 mo. at 7 $\frac{1}{2}$ per cent. = \$3112.50

" " \$3000 for 12 mo. at 7 $\frac{1}{2}$ " = \$3225

\$3000 + \$3112.50 + \$3225 = \$9337.50 *Ans.*

(1)

yr.	mo.	da.
1864	6	10, when due ;
1864	1	1, date.
<hr/>		
	5	9

$$(382.50 \times .07 \div 12) \times 5.3 = \$11.825625 ;$$

$$11.825625 + 382.50 = \$394.325625 \text{ Ans.}$$

(2)

yr.	mo.	da.
1864	7	4, when due ;
1862	3	1, when reckoned.
<hr/>		
	2	4 3

$$(612 \times .06 \div 12) \times 28.1 = \$85.986 ;$$

$$85.986 + 612 = \$697.986 \text{ Ans.}$$

(3)

The interest begins on January 1st, and continues 6 months after date, or to January 3d, 1861 = 1 yr. 0 mo. 2 da. ;

$$(3120 \times .07 \div 12) \times 12.0\frac{2}{3} = \$219.613\frac{1}{3} ;$$

$$219.613\frac{1}{3} + 3120 = \$3339.613\frac{1}{3} \text{ Ans.}$$

(4)

The note was due on July 7th, 1862 ;

yr.	mo.	da.
1862	7	7
1861	12	3
<hr/>		
	7	4

$$(786.50 \times .08 \div 12) \times 7.1\frac{1}{3} = \$37.4022 + ;$$

$$37.4022 + 786.50 = \$823.9022 + \text{ Ans.}$$

(5)

This note was on interest 3 months ;

$$\$4560.72 \times .07 \div 12 = 26.6042 ;$$

$$26.6042 \times 3 + 4560.72 = \$4640.532 \text{ Ans.}$$

(6)

This note is payable June 17, 1857, and bears interest
1 yr. 1 mo. 4 da. ;

$$\$1854.83 \times .06 \div 12 = 9.27415 ;$$

$$9.27415 \times 13.1\frac{1}{3} + 1854.83 = 1976.630 \text{ Ans.}$$

(2)

$$£203 \text{ 18s. 6d.} = £203.925 ;$$

$$(203.925 \times .06 \div 12) \times 44.5\frac{1}{2} = 45.4073 ;$$

$$£45.4073 = £45 \text{ 8s. } 1\frac{2}{3}\text{d. Ans.}$$

(3)

$$£215 \text{ 13s. 8d.} = £215.68333 + ;$$

$$(215.68333 \times .06 \div 12) \times 42.3 = 45.617024 + ;$$

$$£45.617024 + = £45 \text{ 12s. 4d. } 0.34 + \text{ far.}$$

(4)

$$£1543 \text{ 10s. 6d} = £1543.525 ;$$

$$(1543.525 \times .04 \div 12) \times 30 = £154.3525 ;$$

$$£154.3525 = £154 \text{ 7s. 0d. } 2.4 \text{ far. Ans.}$$

(5)

$$£1047 \text{ 3s.} = £1047.15 ;$$

$$(1047.15 \times .06 \div 12) \times 16.5 = £86.38905 ;$$

$$86.38905 + £1047.15 = £1133.53905 = £1133 \text{ 10s. } 9\frac{1}{4}\text{d. A.}$$

(6)

$$\begin{aligned} \text{£}511 \text{ 1s. 4d.} &= \text{£}511.0666 + ; \text{£}511.0666 \times .06 \div 12 \times 78 = \\ &\text{£}199.3159 = \text{£}199 \text{ 6s. 3d. 3 far. } \textit{Ans.} \end{aligned}$$

(7)

$$\begin{aligned} \text{£}161.7625 \times .06 \div 12 &= .8088125 ; \\ .8088125 \times 8.4\frac{1}{2} &= \text{£}6.82098541 = \text{£}6 \text{ 16s. 5d. } \textit{Ans.} \end{aligned}$$

PARTIAL PAYMENTS.

(2)

Principal on interest from Feb. 6, 1850, . . \$6478.84

Interest to May 16, 1853, time

of first payment, 3 yr. 3 mo.

10 da. \$1274.17186

First payment is less than the in-

terest: take the interest on prin-

cipal, from May 16, 1853, to

May 16, 1855, 2 years . . 777.4608

The first two payments are less

than the interest: take the in-

terest on principal from May

16, 1855, to Feb. 1, 1856,

8 mo. 15 da. 275.3507

Interest due, \$2326.98336

Amount, \$8805.8236

Since the three payments exceed the interest

we deduct the three payments . . . 3896.48

Sum due, Feb. 1, 1856, \$4909.3433

Interest on \$4909.3433 from Feb. 1, 1856,

to Aug. 11, 1857, 1 yr. 6 mo. 10 da. . . 450.0231

Amount due, Aug. 11, 1857, \$5359.3664

(3)

Principal on interest from Sept. 5, 1851 . . \$7851.04

Interest on principal, to Nov. 13,

1853 (2 yr. 2 mo. 8 da.) . . . \$1031.10325

The first payment being less than
interest, find the interest from

Nov. 13, 1853, to May 10, 1854

(5 mo. 27 da.) 231.60568

The second payment being less than
interest, find the interest from

May 10, 1854, to March 1,

1855 (9 mo. 21 da.) . . . 380.77544

Interest due, 1643.48437Amount, \$9494.52437Sum of payments, 568.98Remainder due, March 1, 1855, \$8925.54437*Answer.*

(4)

Principal on interest from Jan. 3, 1854 . . \$8974.56

Interest to Feb. 16, 1855 (1 yr. 1 mo. 13 da.) . 703.256Amount, \$9677.816Payment Feb. 16, 1855 1875.40Remainder for new principal, Feb. 16, 1855 . \$7802.416Interest to Sept. 15, 1856 (1 yr. 6 mo. 29 da.) 863.249Amount, \$8665.665Payment Sept. 15, 1856 3841.26Remainder for new principal, Sept. 15, 1856 . \$4824.405Interest to Nov. 11, 1857 (1 yr. 1 mo. 26 da.) 390.240Amount, \$5214.646

	Amount,	\$5214.646
Payment, Nov. 11, 1857		<u>1809.10</u>
Remainder for new principal, Nov. 11, 1857 .		\$3405.546
Interest to June 9, 1858 (6 mo. 28 da.) . .		<u>137.735</u>
	Amount,	\$3543.281
Payment June 9, 1858		<u>2421.04</u>
Remainder for new principal, June 9, 1858 .		\$1122.241
Interest to July 1, 1858 (22 da.)		<u>4.800</u>
Amount due, July 1, 1855,		\$1127.041

Answer.

(5)

Principal on interest, from Nov. 1, 1852 . .		\$345.50
Interest to June 20, 1853 (7 mo. 19 da) . .		<u>15.384</u>
	Amount,	\$360.884
Payment June 20, 1853		<u>75.000</u>
Remainder for new principal, June 20, 1853 .		\$285.884
Interest to Dec. 13, 1856 (3 yr. 5 mo. 23 da.) .		<u>69.652</u>
	Amount,	\$355.536
Payment, Jan. 12, 1854	\$10.00	
Payment March 3, 1855	15.50	
Payment Dec. 13, 1856	<u>52.75</u>	
	Their sum,	\$78.25
Remainder for a new principal, Dec. 13, 1856 .		\$277.286
Interest to Oct. 14, 1857 (10 mo. 1 da.) . .		<u>16.228</u>
	Amount,	\$293.514
Payment Oct. 14, 1857		<u>106.75</u>
Remainder for new principal, Oct. 14, 1857, .		\$186.764
Interest to Feb. 4, 1858 (3 mo. 20 da.) . .		<u>3.994</u>
Amount due, Feb. 4, 1858 .		\$190.758 4.

(6)

Principal on interest, from Oct. 19, 1850 . .	\$450.00
Interest to Sept. 25, 1851 (11 mo. 6 da.) . .	<u>33.60</u>
Amount,	\$483.60
Payment Sept. 25, 1851	<u>85.60</u>
Remainder for new principal, Sept. 25, 1851 .	\$398.00
Interest to June 6, 1853 (1 yr. 8 mo. 11 da.) .	<u>54.039</u>
Amount,	\$452.039
Payment July 10, 1852	\$20.00
Payment June 6th, 1853	<u>150.45</u>
Their sum,	<u>\$170.45</u>
Remainder for new principal, June 6, 1853. .	\$281.589
Interest to May 5, 1855 (1 yr. 10 mo. 2 da.) .	<u>43.114</u>
Amount,	\$324.703
Payment Dec. 28, 1854	\$25.125
Payment May 5, 1855	<u>169.000</u>
Their sum,	<u>\$194.125</u>
Remainder for new principal, May 5, 1855 .	\$130.578
Interest to Oct. 18, 1857 (2 yr. 5 mo. 13 da.) .	<u>25.622</u>
Amount due, Oct. 18, 1857,	\$156.200 A.

PROBLEMS IN SIMPLE INTEREST.

(2)

$$9 \text{ mo.} = \frac{3}{4} \text{ yr.} = .75 \text{ yr.};$$

$$P = \frac{178.9552}{.06 \times .75} = \$3976.7822 + \text{Ans.}$$

(3)

$$P = \frac{76.965}{.07 \times 2.5} = \$439.80 \text{ Ans.}$$

(4)

$$10 \text{ mo. } 15 \text{ da.} = \frac{7}{8} \text{ yr.} = .875 \text{ yr.}$$

$$P = \frac{327.3249}{.06 \times .875} = \$6234.76 \text{ Ans.}$$

(5)

$$P = \frac{1500}{.05 \times 1} = \$30000 \text{ Ans.}$$

(6)

$$4 \text{ yr. } 3 \text{ mo.} = 4.25 \text{ yr. ;}$$

$$P = \frac{283.3914}{.07 \times 4.25} = \$952.5761 + \text{ Ans.}$$

(7)

$$3 \text{ yr. } 1 \text{ mo. } 18 \text{ da.} = 3.13\frac{1}{3} \text{ yr. ;}$$

$$R = \frac{460.60}{2100 \times 3.13\frac{1}{3}} = .07 = 7\% \text{ Ans.}$$

(8)

$$1 \text{ yr. } 10 \text{ mo.} = 1.83\frac{1}{3} \text{ yr. ;}$$

$$R = \frac{452.98}{2470.80 \times 1.83\frac{1}{3}} = .10 = 10\% \text{ Ans.}$$

(9)

$$2 \text{ yr. } 7 \text{ mo. } 24 \text{ da.} = 2.65 \text{ yr. ;}$$

$$R = \frac{15.741}{\begin{array}{r} 503.712 \\ 3456 \times 2.64 \\ 432 \\ 108 \end{array}} = .05\frac{1}{2} = 5\frac{1}{2}\% \text{ Ans.}$$

COMPOUND INTEREST

(2)

$$\begin{aligned}
 175 \times .07 + 175 &= \$187.25; \\
 187.25 \times .07 + 187.25 &= \$200.3575; \\
 \$200.3575 - \$175 &= \$25.3575 \text{ Ans.}
 \end{aligned}$$

(3)

$$\begin{aligned}
 240 \times .05 + 240 &= \$252; \\
 252 \times .05 + 252 &= \$264.60; \\
 264.60 \times .05 + 264.60 &= \$277.83; \\
 277.83 \times .05 + 277.83 &= \$291.7215 \text{ Ans.}
 \end{aligned}$$

NOTE.—To multiply the principal by the rate, and then add the principal to the product, is equivalent to multiplying the principal by $1 + \text{rate}$. Hence, the amount, in the last example, may be found thus:

$$\$240 \times 1.05 \times 1.05 \times 1.05 \times 1.05 = \$291.7215.$$

(4)

$$\begin{aligned}
 540.50 \times .06 + 540.50 &= \$572.93 \\
 572.93 \times .06 + 572.93 &= \$607.3058 \\
 607.3058 \times .06 + 607.3058 &= \$643.744148 \\
 \text{Interest on } \$643.744148 \text{ for 6 } &\} \\
 \text{months and 15 days,} &\} \quad 20.92168481 \\
 \text{Amount} &\quad \underline{\$664.66583281}
 \end{aligned}$$

$$664.66583281 - 540.05 = \$124.16583281 \text{ Ans.}$$

The amount for three years may be found, as in the last example, thus:

$$\$540.50 \times 1.06 \times 1.06 \times 1.06 = \$643.744148.$$

(5)

Find, from the Table, the amount of \$1, for 10 years. It is found opposite 10 in the column of years, and

under 7 per cent. It is \$1.96715; and this is what \$1 will amount to, at compound interest, for ten years.

$$\begin{array}{rcl} \text{Then, } \$1.96715 \times 75 & = & \$147.53625 \\ \text{Int. on } \$147.53625, 4 \text{ mo. 21 da.} & = & \underline{4.04495} \\ \text{Amount} & & \underline{\$151.58120} \end{array}$$

(6)

Take from the Table, the amount of \$1 for the given time, which amount is \$1.42576.

Then, multiply this amount by the number of dollars, which is 650, and we shall have the amount. Thus:

$$1.42576 \times 650 = \$926.744 \text{ Ans.}$$

(7)

From the Table, we have,

$$\text{Amount of } \$1 \text{ for 5 years } 1.33822.$$

$$\begin{array}{rcl} \text{Then, } \$1.33822 \times 3475 & = & \$4650.3145 \\ \text{Int. on } 4650.3145 \text{ for 5 mo. 9 da.} & = & \underline{123.2333} \\ \text{Amount at the end of time} & & \$4773.5478 \end{array}$$

$$\text{Hence, } \$4773.5478 - \$3475 = \$1298.5478 \text{ Ans.}$$

If we compute the interest, by the common rule, we shall see how far the result is varied by using the Table.

$$\begin{array}{l} \$3475 + \$208.50, \text{ int. 1 yr.} = \$3683.50, \text{ end 1st yr.} \\ 3683.50 + 221.01, \text{ int. 2d yr.} = \$3904.51, \text{ end 2d yr.} \\ 3904.51 + 234.2706, \text{ int. 3d yr.} = \$4138.7806, \text{ end 3d yr.} \\ 4138.7806 + 248.326846, \text{ int. 4th yr.} = \$4387.107436, \text{ end 4th yr.} \\ 4387.107436 + 263.22644616, \text{ int. 5th yr.} = \$4650.33388216, \text{ end 5th yr.} \\ \text{Int. on amt. 5 mo. 9 da.} = \underline{123.2333} \\ \text{Amount} \quad \underline{\$4773.56718216} \end{array}$$

The difference being nearly two cents, which results from using more decimal places in the second operation.

(8)

$$95637.50 \times 1.06 \times 1.06 \times 1.06 \times 1.06 \times 1.06 \times 1.06 \times 1.06 = \$143803.4388 + 143803.4388 - 95637.50 = \$48165.9388 + \text{Ans.}$$

(9)

$$\begin{array}{r}
 75439.75 \\
 \underline{.04\frac{1}{2}} \\
 377\ 19875 \\
 3017\ 5900 \\
 \hline
 3394.78875 \text{ interest of first year.} \\
 75439.75 \\
 \hline
 78834.53875 \text{ amount of first year.} \\
 \underline{.04\frac{1}{2}} \\
 394\ 1726937\frac{1}{2} \\
 3153\ 3815500 \\
 \hline
 3547.5542437\frac{1}{2} \text{ interest of second year.} \\
 78834.53875 \\
 \hline
 82382.09299 \text{ amount of second year.} \\
 \underline{.04\frac{1}{2}} \\
 411\ 9104649\frac{1}{2} \\
 3295\ 2837196 \\
 \hline
 3707.1941845 \text{ interest of third year.} \\
 82382.09299 \\
 \hline
 86089.28717 \text{ amount of third year.} \\
 \underline{.04\frac{1}{2}} \\
 430\ 4464358\frac{1}{2} \\
 3443\ 5714868 \\
 \hline
 3874.0179226 \text{ interest of fourth year.} \\
 86089.28717 \\
 \hline
 89963.30509 \text{ amount of fourth year.} \\
 75439.75 \\
 \hline
 14523.55509 \text{ compound interest for four years. } \Delta
 \end{array}$$

DISCOUNT.

(1)

\$1.09 $\frac{1}{2}$, amount of \$1 for 1 year 4 months ;

$$615 \div 1.09\frac{1}{2} = \$562.50 \text{ Ans.}$$

(2)

\$1.098, amt. of \$1 for 1 yr. 7 mo. 18 da. ;

$$202.58 \div 1.098 = \$184.499 + \text{ Ans.}$$

(3)

\$1.03, amt. of \$1 for 7 mo. 6 da. ;

$$721 \div 1.03 = \$700 = \text{present worth ;}$$

$$721 - 700 = \$21 = \text{discount. Ans.}$$

(4)

Time, 4 mo. 24 da. ;

\$1.032, amt. of \$1 for 4 mo. 24 da. ;

$$5160 \div 1.032 = \$5000 \text{ Ans.}$$

(5)

\$1.314, amt. of \$1 for 2 yr. 7 mo. 12 da. ;

$$2500 \div 1.314 = \$1902.587 + \text{ Ans.}$$

(6)

1.985 $\frac{5}{8}$, amt. of \$1 for 1 yr. 2 mo. 20 da. ;

$$3000 \div 1.985\frac{5}{8} = 2763.562 +, \text{ present value ;}$$

$$3000 - 2763.562 = \$236.438, \text{ discount. Ans.}$$

(7)

Time, 2 mo. 16 da. ;

\$1.014 $\frac{1}{2}$, amt. of \$1 for 2 mo. 16 da. ; $1400 \div 1.014\frac{1}{2} = \$1379.6123 +$ *Ans.*

(8)

 $10.50 \times 300 = \$3150$, cost ; $12 \times 300 = \$3600$, price on 3 mo. credit ; $3600 \div 1.0175 = \$3538.0835$, cash value ; $3538.0835 - 3150 = \$388.0835 +$, gain.

(9)

Cash = \$5000.00000

\$1.015, amt. of \$1 for 3 mo. ; $2500 \div 1.015 = \$2463.05418 +$ \$1.03, amt. of \$1 for 6 mo. ; $2500 \div 1.03 = \$2427.18446 +$

Cash value, \$9890.23864 +

(10)

\$1.02, amt. of \$1 for 4 mo. ; $.075 \div 1.02 = \$0.07352$, present value at 3 mo. ;\$1.03, amt. of \$1 for 6 mo. ; $.08 \div 1.03 = \$0.07766$, present value at 6 mo. ; $0.07766 - 0.07352 = 0.00414$.Most advantageous to buy at $7\frac{1}{2}$ cents per pound. *Ans.*

(11)

 $10 \times .20 = \$2.00$, gain ; $10 + 2 = \$12$, price at which it was sold ; $1 - .10 = 90$; the selling price was 90% of the asking price ; hence, $12 \div 90.90 = \$13.333\frac{1}{3}$ *Ans.*

(12)

Time of discount and interest of first note is 1 mo.; of the second, 3 mo. 9 da.; of the third, 4 mo.

	mo. da.	
\$1.005, amt. of \$1 for 1		$1000 \div 1.005 = \$995.0248 +$
\$1.0165, " \$1 " 3 9;		$500 \div 1.0165 = \$491.8839 +$
\$1.02, " \$1 " 4;		$900 \div 1.02 = \$882.3529 +$

Cash value of 3 notes on July 1, \$2369.2617 +

The amount of \$1000 for 1 mo. at 6%. . \$1005

" " of \$500 " 3 mo. 9 da. at 6% 508.25

" " of \$900 " 4 mo. at 6% . . 918.00

Value of 3 notes when due, \$2431.25

2369.2617

Difference, \$61.9883

BANK DISCOUNT.

(1)

Time, 4 mo. 3 da. = 4.1 mo.; $(300 \times .06 \div 12) \times 4.1 = \6.15

(2)

$(200 \times .09 \div 12) \times 5.1 = \7.65 Ans.

(3)

$(500 \times .065 \div 12) \times 8.6 = \$23.2913 + \text{dis.};$

$500 - 23.2916 = \$476.7084 + \text{cash value.}$

(4)

$(1255.38 \times .07 \div 12) \times 4.1 = \$30.0245 + \text{dis.};$

$1255.38 - 30.0245 = \$1225.3555 + \text{Ans.}$

(5)

Time, 1 mo. 15 da. = 1.5 mo.;

$(500 \times .07 \times 12) \times 1.5 = \$4.375.$ Ans.

(6)

$$4368 \times 1.25 = \$5460, \text{ cost of the wheat;}$$

$$4368 \times 1.30 = \$5678.40, \text{ sold it for;}$$

$$5678.40 \times 0.7 \div 12 = \$33.124;$$

$$33.124 \times 4.1 = \$135.8084 + \text{dis.};$$

$$5678.40 - 135.8084 = \$5542.5916;$$

$$5542.5916 - 5460 = 82.5916, \text{ gain.}$$

(7)

$$(7000 \times .06 \div 12) \times 7.1 = \$248.50, \text{ bank discount;}$$

$$\$1.035, \text{ amount of \$1 for 7 months;}$$

$$7000 \div 1.035 = \$6763.285 +, \text{ present value;}$$

$$7000 - 6763.285 = \$236.715, \text{ true discount;}$$

$$248.50 - 236.715 = \$11.785, \text{ difference. Ans.}$$

(8)

$$(10000 \times .08 \div 12) \times 4.6 = \$306.66\frac{2}{3}, \text{ bank discount;}$$

$$10000 \div 1.03 = \$9708.7378 +, \text{ present value;}$$

$$10000 - 9708.7378 = \$291.2622 +, \text{ true discount;}$$

$$306.6666 - 291.2622 = \$15.4044 +, \text{ difference. Ans.}$$

(9)

$$\text{Time, 4 mo. 3 da.} = 4.1 \text{ mo.};$$

$$(1000 \times .05\frac{1}{2} \div 12) \times 4.1 = \$18.7916 +, \text{ discount;}$$

$$1000 - 18.7916 = \$981.2083 +, \text{ or } 981.21 \text{ Ans.}$$

(10)

When A turns in the note at the bank, it will have 4 months and 3 days to run; therefore, they will take discount on \$1500 for 4 months and 3 days, which will be \$25.625; \$1000 + \$25.625 = \$1025.625 taken from \$1500 leaves \$474.375 what A received back.

(2)

 $(1 \times .07 \div 12) \times 6.1 = \$.0355\frac{5}{8}$, discount of \$1 ; $1 - .0355\frac{5}{8} = \$.9644\frac{1}{8}$, present value of \$1 ; $285.95 \div .9644\frac{1}{8} = \296.50 *Ans.*

(3)

 $\$.0968$, present value of \$1 for 6 mo. 12 da. ; $674.89 \div .968 = \$697.20$ *Ans.*

(4)

 $\$.096$, present value of \$1 for 9 mo. 18 da. ; $1000 \div .96 = \$1041.66\frac{2}{3}$ *Ans.*

(5)

 $9.125 \times 380 = \$3467.50$, cost of the flour ; $.9845$, present value of \$1 for 3 mo. 3 da., at 6 per cent ; $3467.50 \div .9845 = \$3522.092$, face of the note.

STOCKS.

(2)

\$100 per share ; $100 \times 43 = \$4300$, value of 43 shares ; $4\frac{1}{2}\%$ semi-annually gives 9% annually, or $.04\frac{1}{2} \times 2 = .09$;hence, $100 \times 43 \times .04\frac{1}{2} \times 2 = \387.00 *Ans.*

(3)

 $100 \times 18 \times .05 = \90.00 *Ans.*

(4)

 $5416 \times .47\frac{1}{4} = \2559.06 , A's ; $6795 \times .47\frac{1}{4} = \3210.6375 , B's.

(5)

 $25 \times 36 \times .17 = \153.00 *Ans.*

(2)

$100 \times 56 = \$5600$, cost at par ; as discount diminishes and brokerage increases the cost, the discount may be considered equal to $.05\frac{1}{2} - .00\frac{1}{2} = .05$;

$5600 \times .05 = \$280$; $5600 - 280 = \$5320$, cost or market value

(3)

$1.2\frac{1}{2} - .00\frac{1}{2} = .12 =$ discount less brokerage ;

$100 \times 36 \times .12 = \432 ; $3600 - 432 = \$3168$, cost ;

$100 \times 36 \times .07 = \252 , premium ;

$3600 + 252 = \$3852$, selling price ;

$100 \times 36 \times .00\frac{1}{2} = \18 , brokerage ;

$3852 - 3168 = \$684$, total gain ; $684 - 18 = \$666$, net gain.

(4)

$75 \times 216 \times .07\frac{3}{4} = \1255.50 ;

$75 \times 216 + 1255.50 = \17455.50 *Ans.*

(5)

$200 \times 257 \times .15 = \7710 ; $200 \times 257 + 7710 = \59110.00

(6)

$150 \times 120 \times .18\frac{3}{4} = \3375 ; $150 \times 120 + 3375 = \21375

(7)

$125 \times 69 \times .07\frac{1}{4} = \625.3125 ;

$125 \times 69 - 625.3125 = \7999.6875 *Ans.*

(8)

$1000 \times 200 \times .06\frac{3}{4} = \13500 ;

$1000 \times 200 + 13500 = \213500 *Ans.*

(9)

$20 \times 125 = \$2500$, par val.; $2500 \times .05 = \$125 = 1\text{st div.}$;
 $2500 \times .04 = \$100 = 2\text{d div.}$; $2500 \times .10 = \$250$, premium;
 $(125 \times .07 \div 12) \times 8 = \$5.83\frac{1}{3}$, int. on 1st div. for 8 mo.;
 $(100 \times .07 \div 12) \times 2 = \$1.16\frac{2}{3}$, " 2d " 2 mo.;
 $125 + 100 + 250 + 5.83\frac{1}{3} + 1.16\frac{2}{3} = \482 , income of $\$2500$;
 $2500 \times .07 \div 12 \times 12 = \175 , interest of $\$2500$ to be de-
 ducted; $482 - 175 = \$307$, net profit. *Ans.*

(2)

$$\frac{\text{Difference}}{1 - \text{Rate}} = \frac{3000}{.85} = \$3529.411 + \text{Ans.}$$

(3)

$$\frac{6384}{1.14} = \$5600 \text{ par value; } 5600 \div 100 = 56 \text{ shares. } \text{Ans.}$$

(4)

$$\frac{3700}{.925} = \$4000 \text{ Ans.}$$

(5)

$$\frac{7000}{.9675} = \$7235.142 + \text{Ans.}$$

(6)

$$\frac{8700}{1.0875} = \$8000 \text{ A.}$$

(7)

$$\begin{aligned}
 12000 \times .03\frac{1}{2} &= \$420, \text{ discount;} \\
 12000 - 420 &= \$11580, \text{ market val.,} \\
 11580 \div 1.11 &= \$10432.432 + \text{Ans.}
 \end{aligned}$$

(2)

$$\begin{aligned}
 1 - 12\frac{1}{2} &= \$37\frac{1}{2}, \text{ market value of } \$1; \\
 1 \times .07 &= \$0.07, \text{ interest of } \$1 \text{ for 1 year;} \\
 .07 \div .875 &= .08, \text{ or } 8\% \text{ Ans.}
 \end{aligned}$$

(3)

$$\begin{aligned}
 .02\frac{1}{2} \times 2 &= .05, \text{ annual dividend;} \\
 .05 \div .625 &= .08, \text{ or } 8\% \text{ Ans.}
 \end{aligned}$$

(4)

$$.07 \div .875 = .08, \text{ or } 8\% \text{ Ans.}$$

(5)

$$.06 \div 1.20 = .05, \text{ or } 5\%$$

(2)

$$1 \times .08 = \$.08, \text{ interest of } \$1; .08 \div .10 = .80, \text{ market value of } \$1, \text{ or } 80\% \text{ of par value; } 1 - .80 = .20, \text{ or } 20\% \text{ dis.}$$

(3)

$$.07 \div .12 = .58\frac{1}{3}; 1 - .58\frac{1}{3} = .41\frac{2}{3}, \text{ or } 41\frac{2}{3}\% \text{ Ans.}$$

(4)

$$.09 \div .08 = 1.12\frac{1}{2}; 1.12\frac{1}{2} - 1 = .12\frac{1}{2}, \text{ or } 12\frac{1}{2}\% \text{ premium A.}$$

(2)

$$\frac{1 \times .06}{1} = .06 = 6\%; \frac{1 \times .07}{1.07} = .0654 + = 6\frac{54}{100}\%; 7\% \text{ best.}$$

(3)

$$\frac{1 \times .08}{1.20} = .06\frac{2}{3} = 6\frac{2}{3}\%; \frac{1 \times .05}{.80} = .06\frac{1}{4} = 6\frac{1}{4}\%; 8\% \text{ best.}$$

(4)

$$\$1 \times .05 \div 1.00 = .05 \text{ rate of profit of the 5 per cent. ;}$$

$$\$1 \times .06 \div .90 = .06\frac{2}{3} \text{ rate of profit of the 6 per cent. ;}$$

$$2000 \times .05 \times 5 = \$500 \text{ profit for 5 yr. of the 5 per cent. ;}$$

$$2000 \times .06\frac{2}{3} \times 5 = \$666.66\frac{2}{3} \text{ for 5 yr. of the 6 per cent. ;}$$

$$\$666.66\frac{2}{3} - 500 = \$166.66\frac{2}{3} \text{ difference of proceeds.}$$

INSURANCE.

(1)

$$147674 \times .03\frac{1}{2} = \$5168.59 \text{ Ans.}$$

(2)

$$47520 \times .005 = \$237.60; 47520 \times .00\frac{1}{2} = \$158.40 \text{ Ans}$$

(3)

$$16800 \times .01\frac{1}{2} = \$252; 16800 \times .00\frac{3}{4} = \$126.00 \text{ Ans.}$$

(4)

$$\frac{2}{3} \text{ of } \frac{3}{4} \text{ of } 24000 = \$12000; 12000 \times 02\frac{1}{2} = \$300 \text{ Ans.}$$

(5)

$$5640 \times .00\frac{3}{4} = \$42.30; 75600 \times 00\frac{3}{4} = 47.25;$$

$$42.30 + 47.25 = \$89.55 \text{ Ans.}$$

(6)

$$75 \text{ cents per } 100 = \frac{3}{4} \text{ of } \$1 \text{ per } \$100 = \frac{3}{4}\%;$$

$$425 \times 15 \times .00\frac{3}{4} = \$47.8125 \text{ Ans.}$$

(7)

$$150 \times 63 \times .35 = \$3307.50, \text{ first cost};$$

$$150 \times 63 \times .50 = \$4725, \text{ selling price};$$

$$4725 \times .035 = \$165.375, \text{ insurance};$$

$$3307.50 + 165.375 = \$3472.875, \text{ whole cost};$$

$$4725 - 3472.875 = \$1252.125, \text{ gain Ans.}$$

(8)

$$3640 \times .04\frac{1}{2} = \$163.80 \text{ insurance} = \text{loss in case of destruction.}$$

(9)

$$12000 \times .0275 = \$330; 18500 \times .0325 = \$601.25;$$

$$330 + 601.25 = \$931.25; 20450 + 25600 + 931.25 = \$46981.25;$$

$$12000 + 18500 = \$30500; 46981.25 - 30500 = \$16481.25$$

total loss. *Ans.*

(10)

$$5000 \times 10.50 = \$52500, \text{ value of the flour};$$

$$2887.50 \div 52500 = .05\frac{1}{2}, \text{ or } 5\frac{1}{2} \text{ per cent. for insurance.}$$

(11)

$$120 \div 7500 = .01\frac{2}{5}, \text{ or } 1\frac{2}{5} \text{ per cent. } \textit{Ans.}$$

(12)

$$225 \times 40 \times 3.50 = \$31500, \text{ cost of cloth ;}$$

$$\$1323 \div 31500 = .04\frac{1}{5}, \text{ or } 4\frac{1}{5}\% \text{ for insurance. } \textit{Ans.}$$

(13)

$$1320 \div .055 = \$24000. \textit{Ans.}$$

(14)

$$51 \div .015 = \$3400, \text{ value of storehouse ; } 126.45 \div .0225$$

$$= \underline{\$5620}, \text{ " " contents ;}$$

$$\$9020, \text{ whole value of property insured.}$$

(15)

$$275 \times 15 = \$4125, \text{ value of pianos ; } \$4125 \times .03 = \$123.75,$$

$$\text{premium ; } 123.75 \times .03 = \$3.7125, \text{ insurance on premium ;}$$

$$123.75 + 3.7125 = 127.4625, \text{ amount of insurance.}$$

(16)

$$16750 \times .0175 = \$293.125, \text{ premium ;}$$

$$293.125 \times .0175 = \$5.1296, \text{ amount of premium ;}$$

$$293.125 + 5.1296 = \$298.2546, \text{ amount of insurance.}$$

LIFE INSURANCE.

(1)

(2)

$$8950 \times 1.36 \div 100 = \$121.72 \quad 12500 \times 1.86 \div 100 = \$232.50$$

(3)

(4)

$$15000 \times 1.75 \div 100 = \$262.50 \quad 5000 \times .00\frac{4}{5} = \$20 \textit{Ans.}$$

(5)

$$2000 \times 4.91 \div 100 = \$98.20 \text{ Ans.}$$

(6)

$$1500 \times .04\frac{3}{4} \times 20 = \$1380; 1500 - 1380 = \$120.00 \text{ Ans.}$$

(7)

$$\begin{aligned} &10000 \times 2.71 \div 100 = \$271, \text{ annual premium;} \\ &\$271, \text{ premium paid at the beginning of the 1st year;} \\ &47.425, \text{ interest on } \$271, \text{ 2 years 6 months;} \\ &271, \text{ premium paid at the beginning of the 2d year;} \\ &28.455, \text{ interest on } \$271, \text{ 1 year 6 months;} \\ &271, \text{ premium paid at the beginning of the 3d year;} \\ &9.485, \text{ interest on } \$271, \text{ 0 year 6 months;} \\ &\$898.365, \text{ premiums and interest;} \\ &10000 - 898.365 = \$9101.635 \text{ Ans.} \end{aligned}$$

ENDOWMENTS.

(1)

$$\begin{aligned} 100 : 250 :: 164.46 : x &= 411.15; \\ \frac{250 \times 164.46}{100} &= \$411.15 \text{ Ans.} \end{aligned}$$

(2)

$$\begin{aligned} 100 : 360 :: 210.53 : x &= 757.908; \\ \frac{360 \times 210.53}{100} &= \$757.908 \text{ Ans.} \end{aligned}$$

(3)

$$\begin{aligned} 100 : 650 :: 188.83 : x &= 1227.395; \\ \frac{650 \times 188.83}{100} &= \$1227.395 \text{ Ans.} \end{aligned}$$

ANNUITIES.

(1)

$$12.821153 \times 550 = \$7051.63415 \text{ Ans.}$$

(2)

$$10.83777 \times 835 = \$9049.53795 \text{ Ans.}$$

(3)

$$15.372451 \times 1500 = \$23058.6765 \text{ Ans.}$$

(4)

$$27560 \div 12.550358 = \$2195.95 \text{ Ans.}$$

(5)

$$25000 \div 11.469921 = \$2179.63; 217963 - 20 = \$2159.613$$

ASSESSING TAXES.

(1)

$$1465.50 + 350.25 + 200.25 = 2016, \text{ tax to be raised;}$$

$$1.50 \times 350 = \$525, \text{ poll tax; } 2016 - 525 = \$1491, \text{ tax on property; } 1491 \div 318200 = .0046 = \frac{23}{50}\% \text{ Ans.}$$

(2)

$$98415 \times .25 = \$24603.75; 100406 - 24603.75 = \$75802.25;$$

$$75802.25 \div .002 = 37901125 \text{ Ans.}$$

(3)

$$56450 \times 25 = \$14112.50, \text{ poll tax; } 87467 - 14112.50 =$$

$$\$73354.50; 73354.50 \div 4890300 = .015 = 1\frac{1}{2} \text{ per cent;}$$

$$5400 \times .015 = \$81; 81 + (.25 \times 5 = 1.25) = \$82.25. A.$$

$$3760.50 \times .015 = \$56.4075; 56.4075 + .50 = \$56.9075 A.$$

(4)

$$40 \times .50 = \$20; 957.50 - 20 = \$937.50;$$

$$937.50 \div 125000 = .0075 = \frac{3}{4} \text{ per cent. } \textit{Ans.}$$

$$2000 \times .0075 = \$15; 15 + .50 = \$15.50 \textit{ Ans.}$$

(5)

$$674.50 \div .975 = \$5820.$$

(6)

$$21346.75 \div .96 = \$22236.197$$

(7)

$$4423.2475 \div .95 = \$4656.05, \text{ whole tax to be raised;}$$

$$150 \times .50 = \$75 \text{ poll tax; } 4656.05 - 75 = \$4581.05 \text{ to be}$$

$$\text{raised on taxable property;}$$

$$4581.05 \div 916210 = .005, \text{ or } \frac{1}{2} \text{ per cent. } \textit{Ans.}$$

$$2100 + 3000 = 5100; 5100 \times .005 = \$25.50;$$

$$25.50 + 1.50 = \$27 \textit{ Ans.}$$

$$1275.50 \times .005 = \$6.3775; 6.3775 + .50 = \$6.8775, \text{ G's tax.}$$

$$2456 \times .005 = \$12.28; 12.28 + .50 = \$12.78, \text{ H's tax.}$$

(8)

$$2850 \div 190000 = .015, \text{ or } 1\frac{1}{2}\% = 1\frac{1}{2} \text{ cents on } \$1 \textit{ Ans.}$$

$$7500 \times .015 = \$112.50 \textit{ Ans.}$$

$$1200 \times .015 = \$18 \textit{ Ans.}$$

(9)

$$60 \times 6 = \$360; 360 + 66 = \$426; 426 - 41.60 = \$384.40;$$

$$384.40 \div 76.88 = .05, \text{ tax per day; } 148 \times .05 = \$7.40 \textit{ Ans}$$

$$184\frac{1}{2} \times .05 = \$9.225 \textit{ Ans.}$$

EQUATION OF PAYMENTS.

(1)

$$\begin{array}{rcl}
 200 \times 4 & = & 800 \\
 400 \times 10 & = & 4000 \\
 600 \times 16 & = & 9600 \\
 \hline
 1200 & & 14400 \\
 14400 \div 1200 & = & 12 \text{ mo. } \textit{Ans}
 \end{array}$$

(2)

$$\begin{array}{rcl}
 \frac{1}{3} \text{ of } 2400 & = & 800 \times 6 = 4800 \\
 \frac{1}{4} \text{ " } & & = 600 \times 8 = 4800 \\
 \frac{5}{12} \text{ " } & & = \frac{1000}{2400} \times 12 = \frac{12000}{21600}
 \end{array}$$

$$21600 \div 2400 = 9 \text{ mo. } \textit{Ans.}$$

(3)

$$\begin{array}{rcl}
 (\frac{1}{3} \text{ of } 4500) & = & 750 \times 4 = 3000 \\
 (\frac{1}{3} \text{ " } & & =) 1500 \times 6 = 9000 \\
 (\frac{1}{3} \text{ " } & & =) \frac{2250}{4500} \times 12 = \frac{27000}{39000}
 \end{array}$$

$$39000 \div 4500 = 8\frac{2}{3} \text{ mo. } \textit{A.}$$

(4)

$$\begin{array}{rcl}
 240 \times 3 & = & 720 \\
 360 \times 5 & = & 1800 \\
 600 \times 10 & = & \frac{6000}{1200} \\
 & & 8520
 \end{array}$$

$$8520 \div 1200 = 7\frac{1}{10} \text{ mo.} = 7 \text{ mo. } 3 \text{ da.}$$

(5)

$$\begin{array}{rcl}
 960 \times 0 & = & 000 \\
 960 \times 6 & = & 5760 \\
 960 \times 7 & = & 6720 \\
 960 \times 12 & = & \frac{11520}{3840} \\
 & & 24000
 \end{array}$$

$$24000 \div 3840 = 6\frac{1}{4} \text{ mo. } \textit{Ans.}$$

(6)

$$\begin{array}{rcl}
 1000 \times 0 & = & 0000 \\
 1200 \times 3 & = & 3600 \\
 800 \times 8 & = & 6400 \\
 1500 \times 10 & = & 15000 \\
 500 \times 12 & = & \frac{6000}{5000} \\
 & & 31000
 \end{array}$$

$$31000 \div 5000 = 6\frac{1}{5} \text{ mo.} = 6 \text{ mo. } 6 \text{ da.}$$

(7)

$$\begin{array}{rcl}
 200 \times 0 & = & 000 \\
 150 \times 31 & = & 4650 \\
 250 \times 45 & = & \frac{11250}{600} \\
 & & 15900
 \end{array}$$

$$15900 \div 600 = 26\frac{1}{2} \text{ days from July 1 ; or, July 28. } \textit{Ans.}$$

(2)

Bought April 1 .. $\$4350 \times 0 = 0000$ " May 7 .. $3750 \times 36 = 135000$ " June 5 .. $2550 \times 65 = 165750$

<u>10650</u>	<u>300750</u>
--------------	---------------

$300750 \div 10650 = 28\frac{51}{113}$ da. from April 1, or, April 29, the equated time of purchase ; 8 months after which, or, Dec. 29, is the equated time of payment.

(3)

May 1 3 mo. .. Due Aug. 1 .. $\$800 \times 0 = 00000$ June 1 3 mo. .. " Sept. 1 .. $700 \times 31 = 21700$ " 15 4 mo. .. " Oct. 15 .. $900 \times 75 = 67500$ July 25 6 mo. .. " Jan. 25 .. $1000 \times 177 = 177000$

<u>3400</u>	<u>)266200</u>
-------------	----------------

Due in 78 days from Aug. 1 ; or, October 18. *Ans.* $78\frac{5}{17}$ da.

(4)

Jan. 1 4 mo. .. Due May 1 .. $367.20 \times 3 = 1101.60$ " 28 3 mo. .. " Apr. 28 .. $901.80 \times 0 = 0000.00$ Feb. 24 5 mo. .. " July 24 .. $826.38 \times 87 = 71895.06$ Mar. 30 6 mo. .. " Sept. 30 .. $854.88 \times 155 = 132506.40$ May 1 4 mo. .. " " 1 .. $396.50 \times 126 = 49959.00$

<u>3346.76</u>	<u>)255462.06</u>
----------------	-------------------

$76\frac{55416}{167338}$ da.

The equated time of the above bills is 76 days from April 28 ; hence, the equated date is July 13. *Ans.*

(5)

 $8 \times 150 = \$1200 ; 1200 \times 0 = 0000$ $8.50 \times 176 = 1496 ; 1496 \times 15 = 22440$ $9 \times 200 = 1800 ; 1800 \times 40 = 72000$

<u>4496</u>	<u>94440</u>
-------------	--------------

$94440 \div 4496 = 21\frac{3}{167}$, or 21 days. *Ans.*

(2)

The use of \$900 for 5 mo. = that of $\$900 \times 5 = \4500 for 1 mo.; it will require as many months as 480 is contained in 4500, that the use of \$480 may equal that of \$4500 for one month; $4500 \div 480 = 9\frac{3}{8}$ mo. *Ans.*

(3)

$7\frac{1}{2} \times 100 = \750 , cost of flour; $750 \times 3 = 2250$
 $80 \times 500 = \$400.00$, cost of wheat; $2250 \div 400 = 5\frac{5}{8}$ mo. *A.*

(2)

$\$2500 \times 4$ mo. = \$10000 for 1 month;
 $\frac{1600}{900} \times 3$ mo. = $\frac{4800}{\$5200}$ for 1 “

$5200 \div 900 = 5\frac{7}{9}$ mo. from the date of the debt; or,
 $5\frac{7}{9} - 3 = 2\frac{7}{9}$ mo. after the payment of \$1600 *Ans.*

Or, \$1600 for 1 mo. = \$1600 for 1 mo.; as 1600 was paid one month before the time, the balance \$900 may be retained as many months beyond the time, as 900 is contained in 1600; $1600 \div 900 = 1\frac{7}{9}$ mo. after 4 mo.; or $2\frac{7}{9}$ mo. after 3 mo. *Ans.*

(3)

$400 \times 3 = \$1200$ for 1 mo.; $1600 \times 6 = \$9600$ for 1 mo.
 $400 \times 4 = 1600$ for 1 “ $\frac{1100}{4300}$ for 1 “
 $300 \times 5 = 1500$ for 1 “ bal., \$500 = \$5300 for 1 “
 $\$1100$ 4300 for 1 “ $5300 \div 500 = 10\frac{3}{5}$ mo. from
date of debt, or $10\frac{3}{5}$ mo. — 5 = $5\frac{3}{5}$ mo. after last payment. *A.*

(4)

\$900 was due 9 mo. after Jan. 1, or, Oct. 1 = 273 days;
\$520 was paid on June 15, or, 165 days from Jan. 1.

$900 \times 273 = 245700$; $159900 \div 380 = 420\frac{1}{2}$ da., or
 $520 \times 165 \div 85800$; 421 da. from Jan. 1, = Feb. 26 of
 $\frac{380}{159900}$ next year. *Ans.*

(5)

\$500 was due on Feb. 6, 1857, or 92 days from Nov. 6 ;

\$350 was paid on Dec. 3, or 27 days from Nov. 6.

$$500 \times 92 = 46000 ;$$

$$36550 \div 150 = 243\frac{2}{3} \text{ days, or}$$

$$\frac{350}{150} \times 27 = \frac{9450}{36550} ;$$

$$244 \text{ days from Nov. 6, = July 8,}$$

$$150$$

$$36550$$

$$1857.$$

Dr. mult.

(2)

Cr. mult.

$$\text{Jan. 1 .. } 500 \times 79 = 39500$$

$$\text{Jan. 5 .. } 350 \times 75 = 26250$$

$$\text{" 16 .. } 450 \times 64 = 28800$$

$$\text{" 19 .. } 780 \times 61 = 47580$$

$$\text{Feb. 5 .. } 680 \times 44 = 29920$$

$$\text{" 25 .. } 250 \times 55 = 13750$$

$$\text{" 24 .. } 300 \times 25 = 7500$$

$$\text{Feb. 15 .. } 600 \times 34 = 20400$$

$$\text{Mar. 1 .. } 150 \times 19 = 2850$$

$$\underline{1980}$$

$$\underline{107980}$$

$$\text{" 16 .. } 600 \times 4 = 2400$$

$$\underline{2680}$$

$$\underline{110970}$$

$$\underline{107980}$$

$$2990$$

$2680 - 1980 = \$700$, merch. balance ; $2990 \times \frac{.07}{360} = \$.58$,
interest balance ; $700 + .58 = \$700.58$, cash balance. *Ans.*

(3)

Dr.

$$\text{July 1 .. Due Jan. 1 .. } 750 \times 31 = 23250$$

$$\text{" 17 .. " " 17 .. } 600 \times 15 = 9000$$

$$\text{" 25 .. " " 25 .. } 800 \times 7 = \underline{5600}$$

$$\underline{2150}$$

$$\underline{37850}$$

Cr.

$$\text{Feb. 6 .. Due Aug. 6 .. } 800 \times 179 = 143200$$

$$\text{Mar. 7 .. " Sept. 7 .. } 900 \times 147 = \underline{132300}$$

$$\underline{1700}$$

$$\underline{275500}$$

$$\underline{37850}$$

$$\underline{237650}$$

$$2150 - 1700 = \$450, \text{ merch. balance ;}$$

$$237650 \times \frac{.07}{360} = \$46.20, \text{ interest balance ;}$$

$$450 - 46.20 = \$403.80, \text{ cash balance. } \textit{Ans.}$$

(4)

Dr.

May 1 ..	Due Aug. 1 ..	500 × 91 =	45500
" 20 ..	" " 20 ..	675 × 72 =	48600
June 6 ..	" Sept. 6 ..	350 × 55 =	19250
July 9 ..	" Oct. 9 ..	175 × 22 =	3850
		<u>1700</u>	<u>117200</u>

Cr.

May 6 ..	Due Aug. 6 ..	400 × 86 =	34400
" 25 ..	" " 25 ..	620 × 67 =	41540
June 16 ..	" Sept. 16 ..	900 × 45 =	40500
July 20 ..	" Oct. 20 ..	400 × 11 =	4400
		<u>2320</u>	<u>120840</u>
			<u>117200</u>

2320 - 1700 = \$620, merch. balance ; 3640

3640 × $\frac{.07}{360}$ = \$.70, interest balance ;

620 × .70 = \$620.70, cash balance. *Ans.*

(1)

Dr.

Jan. 16 ..	716.75 × 76 =	54473
" 25 ..	900.00 × 67 =	60300
Feb. 7 ..	2765.50 × 54 =	149337
Mar. 19 ..	791.25 × 14 =	11077.50
	<u>5173.50</u>	<u>275187.50</u>
	<u>4327.40</u>	<u>182625.95</u>
	<u>846.10</u>	) 92561.55(109 da.

Cr.

Jan. 19 ..	500.15 × 73 =	36510.95
Feb. 1 ..	1915.25 × 60 =	114915.
Mar. 7 ..	1200.00 × 26 =	31200.
Apr. 2 ..	712.00 × 0 =	00000.
	<u>4327.40</u>	<u>182625.95</u>

Since the larger sum of the items and of the products are on the same side of the account, the equated time is 109 da. backward from April 2 ; or, Dec. 14th, 1860.

(2)

<i>Dr.</i>	May 6 ..	7150.00 × 60 =	429000
	" 16 ..	475.00 × 50 =	23750
	June 17 ..	3475.25 × 18 =	62554.50
	" 21 ..	1516.50 × 14 =	21231.00
	July 5 ..	279.00 × 0 =	00000.00
		<u>12895.75</u>	<u>536535.50</u>
		<u>10446.00</u>	<u>323279.50</u>
	Balance,	2449.75	)213256.00(87 da.

<i>Cr.</i>	May 9 ..	2450.00 × 57 =	139650.00
	" 21 ..	915.00 × 45 =	41175.00
	June 12 ..	4165.50 × 23 =	95806.50
	" 19 ..	2915.50 × 16 =	46648.00
		<u>10446.00</u>	<u>323279.50</u>

Since both the greater sums are on the same side, the equated time is 87 days backward from July 5 ; or, April 9th.

Dr. (3)

June 6 ..	8000	× 40 =	320000.00
" 23 ..	1756.50	× 23 =	40399.50
" 30 ..	2890.75	× 16 =	46252.00
July 12 ..	3000.15	× 4 =	12000.60
	<u>15647.40</u>		<u>418652.10</u>
	<u>12981.50</u>		<u>411797.75</u>
	<u>2665.90</u>		<u>6854.35</u>

2152255 day ; or,
 8 days backward from July 16 = July 13th.

<i>Cr.</i>	June 2 ..	7450.75 × 44 =	327833.00
	" 19 ..	2695.25 × 27 =	72771.75
	July 10 ..	1865.50 × 6 =	11193.00
	" 16 ..	970.00 × 0 =	00000.
		<u>12981.50</u>	<u>411797.75</u>

ACCOUNT OF SALES.

Nov. 5. Commission at $2\frac{1}{2}\%$ on \$517.50 = \$12.93

Dec. 6. " " 640.80 = 16.02

" 19. " " 756 = 18.90

" 23. " " 389.40 = 9.73

Nov. 5 .. 517.50 \times 48 = 24840.00

Dec. 6 .. 640.80 \times 17 = 10893.60

" 19 .. 756.00 \times 4 = 3024.00

" 23 .. 389.40 \times 0 = 000.00

2303.70

38757.60

152.58

4659.58

2151.12

)34098.02(151 $\frac{183973}{151122}$ days.

Nov. 5 .. 12.93 \times 48 = 620.64

" 6 .. 9.00 \times 47 = 423.00

" 10 .. 76.00 \times 43 = 3268.00

Dec. 6 .. 16.02 \times 17 = 272.34

" 19 .. 18.90 \times 4 = 75.60

" 23 .. 9.73 \times 0 = 00.00

152.58

4659.58

The balance is due in 16 days from Dec. 23, or, Jan. 8; or the present value of \$2151.12 for 16 days is due on Dec. 23.

ALLIGATION.

(1)

$$1 \times .75 = .75$$

$$3 \times .50 = 1.50$$

$$2 \times .37\frac{1}{2} = .75$$

6

)3.00(.50. Ans.

(2)

$$1 \times .37\frac{1}{2} = .37\frac{1}{2}$$

$$1 \times .50 = .50$$

$$1 \times .62\frac{1}{2} = .62\frac{1}{2}$$

$$1 \times .80 = .80$$

$$1 \times 1.00 = 1.00$$

5

)3.30(.66. Ans.

(3)	(4)
$5 \times .60 = 3.00$	$50 \times 2. = 100.$
$3 \times .96 = 2.88$	$60 \times .90 = 54.00$
$4 \times .0 = 00$	$36 \times .62\frac{1}{2} = 22.50$
$\overline{12} \quad)5.88(.49. \text{ Ans.}$	$\overline{196} \quad)196.00(\$1.00. \text{ A}$

(5)	(6)
$1 \times 70 = 70$	$1 \times 18 = 18$
$1 \times 72 = 73$	$1 \times 21 = 21$
$1 \times 73\frac{1}{2} = 73\frac{1}{2}$	$1 \times 17 = 17$
$1 \times 77 = 77$	$1 \times 19 = 19$
$1 \times 70 = 70$	$1 = 20 = 20$
$1 \times 80\frac{1}{2} = 80\frac{1}{2}$	$\overline{5} \quad)95(19 \text{ Ans.}$
$\overline{7} \quad)525(75 \text{ Ans.}$	

(7)	(8)
$34 \times .05 = 1.70$	$8 \times .30 = 2.40$
$102 \times .08 = 8.16$	$11 \times .25 = 2.75$
$136 \times .10 = 13.60$	$25 \times .07 = 1.75$
$\overline{34} \times .12 = 4.08$	$\overline{44} \quad)6.90(.15\frac{1}{2}, \text{ mean price.}$
$\overline{306} \quad 27.54$	
$13.77 \text{ } 50\% \quad .15\frac{1}{2} - .15 = \$.00\frac{1}{2}, \text{ loss per lb. ;}$	
$\overline{27.54}$	$.00\frac{1}{2} \times 44 = \$.030, \text{ loss. Ans.}$
$306 \overline{41.31}(13\frac{1}{2} \text{ Ans.}$	

ALLIGATION ALTERNATE.

(1)

$12 \left\{ \begin{array}{l} 8 \\ 10 \\ 14 \end{array} \right\}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	1	1	1
	$\frac{1}{2}$	$\frac{1}{2}$	2	1	1	3

1 lb. at 8 cents ; 1 lb. at 10 cents ; 3 lb. at 14 cents.

$$(2)$$

60	{	40	}	|	|	|	|	|	|	|					
		65									10	10	1	3	4
		75									5	5	4	4	4

The same quantity of each ; or, 1 lb. of each.

$$(3)$$

30	{	10	}	|	|	|	|	|	|	|					
		25									10	1	2	1	
		40									5	10	1	1	2
		50									10	1	1	1	

1 calf, 2 cows, 1 ox, 1 colt.

$$(4)$$

13	{	0	}	|	|	|	|	|	|	|				
		14									13	13	2	3
		15									5	13	13	13

3 gallons of water.

$$(1)$$

8	{	4	}	|	|	|	|	|	|	|			
		6									1	1	1 × 20 = 20
		10									2	1	1 × 20 = 20
		12									1	1	1 × 20 = 20

$20 \div 1 = 20 = \text{ratio}$; 20 lb. of each. *Ans.*

$$(2)$$

10	{	7	}	|	|	|	|	|	|	|			
		11									3	1	3 × 25 = 75
		12									1	3	3 × 25 = 75
		12									3	3	3 × 25 = 75

$75 \div 3 = 25 = \text{ratio}$; 75 lb. of each. *Ans.*

(3)

$$96 \left\{ \begin{array}{l} 84 \\ 90 \\ 108 \\ 114 \end{array} \right\} \left| \begin{array}{l} \frac{1}{12} \\ \frac{1}{18} \end{array} \right| \left| \begin{array}{l} \frac{1}{6} \\ \frac{1}{12} \end{array} \right| \left| \begin{array}{l} 3 \\ 2 \end{array} \right| \left| \begin{array}{l} 2 \\ 1 \end{array} \right| \left| \begin{array}{l} 3 \times 12 = 36 \\ 2 \times 12 = 24 \\ 1 \times 12 = 12 \\ 2 \times 12 = 24 \end{array} \right.$$

$$24 \div 2 = 12 = 24 = \text{ratio};$$

36 gal. at 7s., 24 at 7s. 6d., 12 at 9s., and 24 at 9s. 6d.

(4)

$$1.25 \left\{ \begin{array}{l} 75 \\ 200 \end{array} \right\} \left| \begin{array}{l} \frac{1}{25} \\ \frac{1}{75} \end{array} \right| \left| \begin{array}{l} 3 \times 5 = 15 \\ 2 \times 5 = 10 \end{array} \right.$$

$$10 \div 2 = 5 = \text{ratio}; 15 \text{ at } \$\frac{3}{4}, \text{ and } 10 \text{ at } \$2. \text{ Ans.}$$

(5)

$$8 \left\{ \begin{array}{l} 5 \\ 7 \\ 7\frac{1}{2} \\ 9\frac{1}{2} \\ 10 \end{array} \right\} \left| \begin{array}{l} \frac{1}{3} \\ \frac{1}{2} \end{array} \right| \left| \begin{array}{l} 1 \\ \frac{1}{2} \end{array} \right| \left| \begin{array}{l} 2 \\ \frac{3}{4} \end{array} \right| \left| \begin{array}{l} 2 \\ 3 \end{array} \right| \left| \begin{array}{l} 8 \\ 3 \end{array} \right| \left| \begin{array}{l} 2 \times 12\frac{1}{2} = 25 \\ 2 \times 12\frac{1}{2} = 25 \\ 8 \times 12\frac{1}{2} = 100 \\ 3 \times 12\frac{1}{2} = 37\frac{1}{2} \\ 4 \times 12\frac{1}{2} = 50 \end{array} \right.$$

$$50 \div 4 = 12\frac{1}{2} = \text{ratio};$$

25lb. each, at 5 and 7 cts.; 100 at $7\frac{1}{2}$, $37\frac{1}{2}$ at $9\frac{1}{2}$, and 50 at 10.

(1)

$$7 \left\{ \begin{array}{l} 5 \\ 6 \\ 8 \\ 9 \end{array} \right\} \left| \begin{array}{l} \frac{1}{2} \\ \frac{1}{2} \end{array} \right| \left| \begin{array}{l} 1 \\ 1 \end{array} \right| \left| \begin{array}{l} 1 \\ 1 \end{array} \right| \left| \begin{array}{l} 1 \\ 1 \end{array} \right| \left| \begin{array}{l} 1 \times 22 = 22 \\ 1 \times 22 = 22 \\ 1 \times 22 = 22 \\ 1 \times 22 = 22 \end{array} \right.$$

$$88 \div 4 = 22 = \text{ratio}; 22 \text{ lb. of each. Ans.}$$

(2)

$$2\frac{1}{4} \left\{ \begin{array}{l} 0 \\ 2\frac{1}{2} \\ 3 \end{array} \right\} \left| \begin{array}{l} \frac{4}{9} \\ \frac{4}{3} \end{array} \right| \left| \begin{array}{l} \frac{4}{9} \\ \frac{4}{3} \end{array} \right| \left| \begin{array}{l} 4 \\ 12 \end{array} \right| \left| \begin{array}{l} 4 \\ 36 \end{array} \right| \left| \begin{array}{l} 8 \times 1\frac{1}{8} = 9 \\ 36 \times 1\frac{1}{8} = 40\frac{1}{2} \\ 12 \times 1\frac{1}{8} = 13\frac{1}{2} \end{array} \right.$$

$$63 \div 56 = 1\frac{1}{8} = \text{ratio};$$

9 gal. of water, $40\frac{1}{2}$ gal. at $\$2\frac{1}{2}$, and $13\frac{1}{2}$ at $\$3$ Ans.

J*

(3)

Average price of the animals = $48 \div 40 = \$1\frac{1}{5}$

$1\frac{1}{5}$	$\left\{ \begin{array}{l} \frac{2}{3} \\ 1\frac{1}{2} \\ 1\frac{3}{4} \end{array} \right\}$	|	$\frac{20}{9}$	|	$\frac{20}{20}$	|	220	|	20	|	$240 \times \frac{1}{15} = 16$
									180		$180 \times \frac{1}{15} = 12$
			$\frac{20}{11}$				180		$180 \times \frac{1}{15} = 12$		
<hr/>											
<u>600</u>											

$$40 \div 600 = \frac{40}{600} = \frac{1}{15} = \text{ratio};$$

16 lambs, and 12 sheep, and 12 calves. *Ans.*

(4)

Average price of the stoves = \$9;

9	{	$\begin{array}{l} 6 \\ 7 \\ 19 \end{array}$	|	$\frac{1}{3}$	|	$\frac{1}{10}$	|	10	|	10	|	$10 \times \frac{4}{5} = 8$
				$\frac{1}{10}$		$\frac{1}{10}$		3		2		$10 \times \frac{4}{5} = 8$
				$\frac{1}{10}$		$\frac{1}{10}$		3		2		$5 \times \frac{4}{5} = 4$
<hr/>												
25												

$$20 \div 25 = \frac{20}{25} = \frac{4}{5} = \text{ratio}; 8 \text{ at } 6 \text{ and } 7, \text{ and } 4 \text{ at } 19. \text{ A.}$$

(5)

5	{	$\begin{array}{l} 4 \\ 6 \\ 8 \\ 10 \end{array}$	|	1	|	1	|	1	|	5	|	3	|	1	|	9	|	90
								1						1		1		10
						$\frac{1}{3}$						1				1		10
				$\frac{1}{3}$						1						1		10

$$9 + 1 + 1 + 1 = 12; 120 \div 12 = 10.$$

(6)

6	{	$\begin{array}{l} 2 \\ 5 \\ 12 \end{array}$	$\left. \begin{array}{l} \\ \\ \end{array} \right\}$	$\frac{1}{2}$	|	3	|	3	|	1	|	6
				$\frac{1}{3}$		$\frac{1}{3}$		2		1		6	2	12
<hr/>												
1 + 2 + 1 = 4; 24 ÷ 4 = 6.												

(7)

17	{	$\begin{array}{l} 15 \\ 20 \\ 22 \\ 24 \end{array}$	|	$\frac{1}{2}$	|	$\frac{1}{2}$	|	$\frac{1}{3}$	|	7	|	5	|	3	|	15	|	30
								$\frac{1}{3}$						2		2		4
						$\frac{1}{3}$						2				2		4
				$\frac{1}{3}$						2						2		4

$$15 + 2 + 2 + 2 = 21; 42 \div 21 = 2.$$

$$\begin{array}{r}
 (8) \\
 2 \left\{ \begin{array}{c} \frac{1}{2} \\ 1 \\ 5 \end{array} \right. \left| \begin{array}{c} \frac{2}{3} \\ \frac{1}{3} \end{array} \right| \left| \begin{array}{c} 1 \\ \frac{1}{3} \end{array} \right| \left| \begin{array}{c} 2 \\ 1 \end{array} \right| \left| \begin{array}{c} 3 \\ 1 \end{array} \right| \left| \begin{array}{c} 2 \\ 3 \\ 2 \end{array} \right| \left| \begin{array}{c} 10 \\ 15 \\ 10 \end{array} \right. \\
 2 + 3 + 2 = 7; 35 \div 7 = 5.
 \end{array}$$

CUSTOM-HOUSE BUSINESS.

(3)

9 cwt. 3 qr. 24 lb. = 999 lb.; 999 - 146 = 853 lb.

10 cwt. 2 qr. 12 lb. = 1062 lb.; 1062 - 150 = 912 lb.

11 cwt. 1 qr. 24 lb. = 1149 lb.; 1149 - 158 = 991 lb.

2756 lb. = 27.56 cwt

27.56 × \$9.47 = \$260.9932 Ans.

(4)

6 cwt. 2 qr. 14 lb. = 664 lb.; 664 - 94 = 570 lb.

9 cwt. 1 qr. 20 lb. = 945 lb.; 945 - 100 = 845 lb.

6 cwt. 2 qr. 22 lb. = 672 lb.; 672 - 88 = 584 lb.

7 cwt. 2 qr. 24 lb. = 774 lb.; 774 - 89 = 685 lb.

8 cwt. 0 qr. 13 lb. = 813 lb.; 813 - 100 = 713 lb.

3397 lb.

3397 × .21 = \$713.37 Ans.

(5)

8 cwt. 3 qr. 14 lb. = 8.89 cwt.; 8.89 × 18 = 160.02 cwt.;

160.02 cwt. × 16 = 2560.32 lb. = 25.6032 cwt.;

160.02 - 25.6032 = 134.4168 cwt. = 6 T. 14 cwt. 1 qr. 16.68 lb

(6)

7 T. 11 cwt. 3 qr. = 151.75 cwt.; 151.75 × 12 = 1821 lb. =

18.21 cwt.; 151.75 - 18.21 = 133.54 cwt. = 6 T. 13 cwt

2 qr 4 lb.; 133.54 × 2.31 = \$308.4774 Ans.

(7)

$19 \text{ cwt. } 1 \text{ qr. } 24 \text{ lb.} = 1949 \text{ lb.};$
 $1949 - 149 = 1800 \text{ lb.} = 18 \text{ cwt.};$
 $18 \times 24.28 = \$437.04;$
 $12 \text{ cwt. } 3 \text{ qr. } 19 \text{ lb.} = 1294 \text{ lb.};$
 $1294 - 49 = 1245 \text{ lb.} = 12.45 \text{ cwt.};$
 $12.45 \times 28.56 = \$355.572;$
 $437.04 + 355.572 = \$792.612 \text{ Ans.}$

(8)

$10 \text{ cwt. } 1 \text{ qr. } 14 \text{ lb.} = 10.39 \text{ cwt.};$
 $10.39 \times 17\frac{1}{4} = 179.2275 \text{ cwt., or } 17922.75 \text{ lb.};$
 $7 + 4 = 11 \text{ lb.}; 179.2275 \times 11 = 1971.5025 \text{ lb., draft \& tare.}$
 $17922.75 - 1971.5027 = 15951.2475 \text{ lb.} = 159.512475 \text{ cwt.};$
 $159.512475 \times \$7.50 = \$1196.343 + \text{ Ans.}$

(9)

$4 \text{ cwt. } 3 \text{ qr. } 14 \text{ lb.} = 4.89 \text{ cwt.}; 4.89 \times 7 = 34.23 \text{ cwt.};$
 $34.23 \times 7 = 239.61 \text{ lb., draft}; 8 \times 7 = 56 \text{ lb., tare};$
 $239.61 + 56 + 99.75 = 395.36 \text{ lb.};$
 $34.23 - 395.36 = 3027.64 \text{ lb.} = 30.2764 \text{ cwt.};$
 $30.2764 \times 8.45 = \$255.835 + \text{ Ans.}$

(10)

$22.50 + 12.49 + 5.11 + 1.31 = \$41.41;$
 $11 \text{ cwt. } 1 \text{ qr. } 15 \text{ lb.} = 11.40 \text{ cwt., or } 1140 \text{ lb.};$
 $11.40 \times 11\frac{1}{2} = 127.68 \text{ lb., tare};$
 $1140 - 127.68 = 10.1232 \text{ cwt.};$
 $41.41 \div 10.1232 \text{ cwt.} = \$4.09 + \text{ Ans.}$

(11)

$87 \times 47 = 4089 \text{ gal.}; 4089 \times 9 = 36801 \text{ lb.};$
 $36801 \div 11 = 3345.5454 = \text{tare};$
 $36801 - 3345.5454 = 33455.4546 \text{ lb.} = 334.55454 \text{ cwt.} +;$
 $334.55454 \times 1.19 = \398.1199 Ans.

(12)

13 cwt. 1 qr. 12 lb. = 1337 lb. ; $1337 \times 5 = 6685$ lb., or
 66.85 cwt. ; $1\frac{1}{2} + 5\frac{1}{2} = 7$ lb. ; $66.85 \times 7 = 467.95$ lb. ;
 $6685 - 467.95 = 6217.05$ lb., net weight ;
 $6217.05 \times .07\frac{1}{2} = \$466.278 +$ *Ans.*

(13)

$450 \times 76 = 34200$ lb. ; $34200 \times .08 = 2736$ lb., tare ;
 $34200 - 2736 = 31464$ lb. net weight ;
 $31464 \times .10\frac{1}{2} = \3303.72 , cost ; $3303.72 \times .33\frac{1}{3} = \1101.24 ,
 whole gain ; $3303.72 + 1101.24 = \$4404.96$;
 $4404.96 \div 31464 = \$.14$ per pound. *Ans.*

(14)

$176 \times 46\frac{1}{4} = 8140$ yd. ; $8140 \times 3.25 = \$26455$;
 $26455 \times .30 = 7936.50$, duty. *Ans.*

(15)

54 T. 13 cwt. 3 qr. 20 lb. = 54.6975 tons ;
 $54.6975 \times 45 = \$2461.3875$, cost ;
 $2461.3875 \times .33\frac{1}{3} = \820.4625 , duty. *Ans.*

(16)

$225 \times 160 = 36000$ lb. ; $36000 \times .02 = 720$, tare ;
 $36000 - 720 = 35280$ lb. ; $35280 \times .06 = \$2116.80$, cost ;
 $2116.80 \times .20 = \$423.36$, duty. *Ans.*

(17)

$275 \times 2\frac{3}{4} = 756.25$ gal. ; $756.25 \times .05 = 37.8125$, tare ;
 $756.25 - 37.8125 = 718.4375$ gal. ;
 $718.4375 \times .35 = \$251.453 =$ duty. *Ans.*

(18)

$$175 \times 196 = 34300 \text{ lb.}; 34300 \times .15 = 5145 \text{ lb., tare};$$

$$34300 - 5145 = 29155, \text{ net weight};$$

$$29155 \times .05 = \$1457.75, \text{ duty. Ans.}$$

(19)

$$2 \text{ cwt. } 2 \text{ qr. } 24 \text{ lb.} = 2.74 \text{ cwt.}; 2.74 \times 75 = 205.5 \text{ cwt.};$$

$$205.5 \times .11 = 22.605, \text{ tare};$$

$$205.5 - 22.605 = 182.895 \text{ cwt., net weight};$$

$$18289.5 \times .01\frac{7}{8} = \$342.928; 342.928 \times .20 = \$68.5856, \text{ duty.}$$

TONNAGE OF VESSELS.

(1)

$$(75 - \frac{3}{4} \text{ of } 20) \times 20 \times 17 = 21420; 21420 \div 95 = 225\frac{9}{19} \text{ T.}$$

(2)

$$90 \text{ ft.} \times 22 \text{ ft. } 7 \text{ in.} \times 20 \text{ ft. } 6 \text{ in.} = 41666\frac{1}{4} \text{ ft.};$$

$$41666\frac{1}{4} \div 95 = 438\frac{45}{98} \text{ tons. Ans.}$$

(3)

$$154 \text{ ft.} \times 30 \text{ ft. } 8 \text{ in.} \times 14 \text{ ft. } 8 \text{ in.} = 69265\frac{7}{9} \text{ ft.};$$

$$69265\frac{7}{9} \div 95 = 729\frac{97}{105} \text{ tons. Ans.}$$

(4)

$$34 - 4 = 30 \text{ feet};$$

$$125 \times 25.5 \times 30 = 95625 \text{ ft.}; 95625 \div 95 = 1006.57 + \text{T.}$$

EXCHANGE.

(1)

$$8465 \times .01\frac{1}{2} = \$126.975; 8465 + 126.975 = \$8591.975. A$$

(2)

$$8746.50 \times .01\frac{1}{4} = \$109.33125;$$

$$8746.50 - 109.33125 = \$8637.168 + \text{Ans.}$$

(3)

$$9876.40 \times .01 = \$98.764 ; 9876.40 - 98.764 = \$9777.636$$

(4)

$$10000 \times .0075 = \$75, \text{ premium ; } 10000 + 75 = \$10075, \text{ value of bill at sight ; } (10000 \times .06 \div 12) \times 2.1 = \$105, \text{ interest for 60 days and 3 days' grace ; } 10075 - 105 = \$9970 \text{ A.}$$

(5)

$$1.00 - .0075 = .9925 = 99\frac{1}{4}\% \text{ of the face of the bill} = \$14875 ; \\ 14875 \div 99\frac{1}{4} = \$15006.305 + \text{ face of the bill. Ans.}$$

(6)

$$.06, \text{ rate of interest per annum} = .0055 \text{ for 33 days ; } \\ .01 + .0055 = .0155 = \text{deductions ; } 1.00 - .0155 = .9845 ; \\ 9650 \div .9845 = \$9801.9299 \text{ Ans.}$$

(2)

$$£36794 \text{ 8s. 9d.} = £36794.4375 ; 36794.4375 \times .07\frac{1}{2} = \\ 2851.5689 + \text{prem. ; } 36794.4375 + 2851.5689 = £39646.0064 ; \\ 39646.0064 \times \frac{1}{9} = \$176204.4729 + \text{ Ans.}$$

(3)

$$4.44444\frac{1}{3} \times .09 = .40, \text{ premium ; } 4.44444 + .40 = \$4.84444 = \\ £1 ; 67894.25 \div 4.84444 = £14014.8809 = £14014 \text{ 17s. } \\ 7\text{d. 1 far. Ans.}$$

(4)

$$£1256.9375 \times .07\frac{1}{2} = £94.2703 ; \\ 1256.9375 + 94.2703 = £1351.2078 ; \\ 1351.2078 \times 4.44\frac{1}{3} = \$6005.368 \text{ Ans.}$$

(5)

$$\begin{aligned}
 £364.9333 \times .08\frac{1}{4} &= £30.10699+; \\
 364.9333 + 30.10699 &= 395.0402; \\
 395.0402 \times 4.44\frac{1}{2} &= \$1755.734+; \\
 1755.734 - 947.86 &= \$807.874+ \text{ Ans.}
 \end{aligned}$$

(6)

$$\begin{aligned}
 £1569 \text{ 10s.} &= £1569.5; 1569.5 \times .12 = £188.34 \text{ premium}; \\
 (1569.5 + 188.34) \times \frac{4}{5} &= \$7812.622+; \\
 7812.622 \times .26 &= \$2031.28172, \text{ gain}; \\
 2031.28172 + 7812.622 &= \$9843.90372, \text{ selling price}; \\
 9843.90372 \times .02\frac{1}{2} &= \$246.09759, \text{ commission}; \\
 246.097 + 416 + 85 &= \$747.097+ = \text{sum of deductions}; \\
 9843.903 - 747.097 &= \$9096.806+ \text{ Ans.}
 \end{aligned}$$

(2)

$$\begin{aligned}
 \$17326.274 \div 186 &= 93152.01+ \text{ francs}; \\
 93152.01 - 86978 &= 6174.01; 6174.01 \div 86978 = 07 = 7\%.
 \end{aligned}$$

(3)

$$\begin{aligned}
 18.6 \times .03 &= .558; 18.6 - .558 = 18.042 \text{ cents.} \\
 68097 \times 18.042 &= \$12286.06 \text{ Ans.}
 \end{aligned}$$

(4)

$$\$16785.25 \times 5.04 = 84597 \text{ francs 66 centimes. Ans.}$$

(1)

$$\begin{aligned}
 35 \times .02 &= .7; 35 + .7 = 35.7 \text{ cents}; \\
 18649 \times 35.7 &= \$6657.693 \text{ Ans.}
 \end{aligned}$$

(2)

$$\begin{aligned}
 3678 \times .34 &= \$1250.52 \text{ Ans.}; 35 - 34 = .01; \\
 .01 \div 35 &= .01 = 3\% \text{ nearly, below par.}
 \end{aligned}$$

ARBITRATION OF EXCHANGE.

(2)

\$1 = $\frac{1}{4.86}$ £; 1 £ = 14 marcs banco; 1 marc = $\frac{2}{3}$ florins;

$$\text{hence, } \frac{1}{4.86} \times \frac{14}{1} \times \frac{2}{3} \times \frac{500}{1} = 5761.31 + \text{ florins. } \textit{Ans.}$$

(3)

\$1 at Boston = \$.99 $\frac{1}{2}$ N. Y.; \$1 N. Y. = \$.99 $\frac{1}{2}$ N. O.;
 \$1 N. O. = \$1.00 $\frac{1}{2}$ Natch.; .99 $\frac{1}{2}$ \times .99 $\frac{3}{4}$ \times 1.00 $\frac{1}{2}$ \times 10000 =
 \$9962.219 + *Ans.*

(4)

1 £ = 24.15 fr.; 1 fr. = $\frac{1}{2}$ flor.; 1 sti. = 5 centimes;
 2 flor. 15 sti. = 2.75 flor.; 1 flor. = $\frac{1}{2}$ Sp. doll.;
 $\frac{24.15}{1} \times \frac{1}{2} \times \frac{1}{2} \times 862.5 = 3495.839 + \text{ Sp. dolls. } \textit{Ans.}$

INVOLUTION.

(1)

$$(4)^2 = 16 \text{ A.}$$

(2)

$$(15)^2 = 225 \text{ A.}$$

(3)

$$(.142)^2 = 20164 \text{ A.}$$

(4)

$$(463)^2 = 214369 \text{ Ans.}$$

(5)

$$(1340)^2 = 1795600 \text{ Ans.}$$

(6)

$$(24.6)^2 = 605.16 \text{ Ans.}$$

(7)

$$(.526)^2 = .276676 \text{ Ans.}$$

(8)

$$(3.125)^2 = 9.765625 \text{ Ans.}$$

(9)

$$(.0524)^2 = .00274576 \text{ Ans.}$$

(10)

$$\left(\frac{3}{4}\right)^2 = \frac{9}{16} \text{ Ans.}$$

(11)

$$\left(\frac{6}{7}\right)^2 = \frac{36}{49} \text{ Ans.}$$

(12)

$$\left(\frac{7}{9}\right)^2 = \frac{49}{81} \text{ Ans.}$$

$$\begin{matrix} (13) \\ \left(\frac{35}{84}\right)^2 = \frac{1225}{7056} \end{matrix} A.$$

$$\begin{matrix} (14) \\ \left(\frac{125}{247}\right)^2 = \frac{15625}{61009} \end{matrix} A.$$

$$\begin{matrix} (15) \\ (7\frac{1}{2})^2 = (7.625)^2 = 58.140625 \end{matrix} A.$$

$$\begin{matrix} (16) \\ (15\frac{2}{11})^2 = \left(\frac{174}{11}\right)^2 = \frac{30276}{121} = 250\frac{26}{121} \end{matrix} Ans.$$

$$\begin{matrix} (17) \\ (225\frac{9}{10})^2 = (225.9)^2 = 51030.81 \end{matrix} A.$$

$$\begin{matrix} (18) \\ (6)^3 = 216 \end{matrix} Ans.$$

$$\begin{matrix} (19) \\ (24)^3 = 13824 \end{matrix} Ans.$$

$$\begin{matrix} (20) \\ (125)^3 = 1953125 \end{matrix} Ans.$$

$$\begin{matrix} (21) \\ (136)^3 = 2515456 \end{matrix} Ans.$$

$$\begin{matrix} (22) \\ (12)^4 = 20736 \end{matrix} Ans.$$

$$\begin{matrix} (23) \\ (9)^5 = 59049 \end{matrix} Ans.$$

$$\begin{matrix} (24) \\ (4.25)^3 = 76.765625 \end{matrix} Ans.$$

$$\begin{matrix} (25) \\ (1.8)^4 = 10.4976 \end{matrix} Ans.$$

$$\begin{matrix} (26) \\ (.45)^5 = .0184528125 \end{matrix} Ans.$$

$$\begin{matrix} (27) \\ \left(\frac{15}{16}\right)^3 = \frac{3375}{4096} \end{matrix} A.$$

$$\begin{matrix} (28) \\ \left(\frac{5}{6}\right)^3 = \frac{125}{216} \end{matrix} A.$$

$$\begin{matrix} (29) \\ \left(\frac{3}{8}\right)^4 = \frac{81}{4096} \end{matrix} A.$$

$$\begin{matrix} (30) \\ (2\frac{1}{4})^5 = \left(\frac{9}{4}\right)^5 = 57\frac{681}{1024} \end{matrix} Ans.$$

$$\begin{matrix} (31) \\ \left(\frac{25}{27}\right)^4 = \frac{390625}{531441} \end{matrix} Ans.$$

(32)

$$(24\frac{3}{5})^3 = (24.6)^3 = 14886.936 \text{ Ans.}$$

(33)

$$(.25)^6 = .000244140625 \text{ A.}$$

(34)

$$(142.5)^3 = 2893640.625 \text{ A.}$$

EXTRACTION OF THE SQUARE ROOT.

(3)

$$\sqrt{49} = 7 \text{ Ans.}$$

(4)

$$\sqrt{144} = 12 \text{ Ans.}$$

(5)

$$\sqrt{225} = 15 \text{ Ans.}$$

(6)

$$\sqrt{2304} = 48 \text{ Ans.}$$

(7)

$$\sqrt{7994} = 89.409 + \text{Ans.}$$

(8)

$$\sqrt{6275025} = 2505 \text{ Ans.}$$

(9)

$$\sqrt{19000} = 137.84 + \text{Ans.}$$

(10)

$$\sqrt{2768456} = 1663.8677 + \text{A.}$$

(11)

$$\sqrt{36754} = 191.713 + \text{A.}$$

(12)

$$\sqrt{1000000} = 1000 \text{ Ans.}$$

(13)

$$\sqrt{96728} = 311.011 + \text{Ans.}$$

(14)

$$\sqrt{30225} = 173.853 + \text{Ans.}$$

(4)

$$\sqrt{\frac{8}{81}} = \frac{2}{9} \text{ Ans.}$$

(5)

$$\sqrt{\frac{225}{2304}} = \frac{15}{48} \text{ A.}$$

(6)

$$\sqrt{.0196} = .14 \text{ Ans.}$$

(7)

$$\sqrt{6.25} = 2.5 \text{ Ans.}$$

(8)

$$\sqrt{278.89} = 16.7 \text{ Ans.}$$

(9)

$$\sqrt{.205209} = .453 \text{ Ans.}$$

(10)

$$\sqrt{\frac{1}{8}} = \sqrt{.125} = .35 + \text{Ans.}$$

$$\begin{array}{ll} (11) & (12) \\ \sqrt{1\frac{5}{8}} = \sqrt{.9375} = .9682 + A. & \sqrt{\frac{1}{40}} = \sqrt{.025} = .1581 + \end{array}$$

$$\begin{array}{ll} (13) & (14) \\ \sqrt{5\frac{4}{9}} = \frac{7}{3} = 2\frac{1}{3} \text{ Ans.} & \sqrt{.7994} = .89409 + \text{ Ans.} \end{array}$$

$$\begin{array}{ll} (15) & (16) \\ \sqrt{.222\bar{2}} = \sqrt{.22222222} = .4714 + & \sqrt{.60794} = .779 + A. \end{array}$$

$$\begin{array}{ll} (17) & (18) \\ \sqrt{.022201} = .149 + \text{ Ans.} & \sqrt{25.1001} = 5.01 \text{ Ans.} \end{array}$$

$$\begin{array}{ll} (19) & (20) \\ \sqrt{196.425} = 14.015 + \text{ Ans.} & \sqrt{1.5} = 1.2247 + \text{ Ans.} \end{array}$$

$$\begin{array}{lll} (21) & (22) & (23) \\ \sqrt{\frac{2809}{6241}} = \frac{53}{79} A. & \sqrt{\frac{9}{49}} = \frac{3}{7} A. & \sqrt{\frac{2}{25}} = \sqrt{.08} = .2828 + \end{array}$$

$$\begin{array}{ll} (24) & (25) \\ \sqrt{135} = 11.618 + \text{ Ans.} & \sqrt{.784} = .885 + \text{ Ans.} \end{array}$$

$$\begin{array}{ll} (26) & (27) \\ \sqrt{5647.5225} = 75.15 \text{ Ans.} & \sqrt{160048.0036} = 400.06 A. \end{array}$$

$$\begin{array}{ll} (1) & (2) \\ \sqrt{117649} = 343 \text{ men. Ans.} & \sqrt{48841} = 221 \text{ stones. A.} \end{array}$$

(3)

810 × 10 = 8100 sq. ft., area of garden ;

 $\sqrt{8100} = 90$ ft. = length of each side ;

90 × 4 = 360 ft. = length of the four sides ;

 $360 \div 16\frac{1}{2} = 21\frac{2}{11}$ rd. Ans.

(4)

By dividing the rectangle breadthwise into 3 equal parts, each of which will be a square, and equal to $\frac{1}{3}$ of the whole area ; 67 A. 2 R. = 10800 P. ; $10800 \div 3 = 3600$ P. ;

$\sqrt{3600} = 60$ rd., width ; $60 \times 3 = 180$ rd., length. *Ans.*

(5)

$3200 \div 2 = 1600$, number of trees in half the field ;

$\sqrt{1600} = 40$, number of trees in width ;

$40 \times 2 = 80$, number of trees in length ;

$(80 - 1) \times 12 = 948$ feet long ; $948 \times 468 = 443664$ sq. ft.

$(40 - 1) \times 12 = 468$ feet wide ;

443664 sq. ft. = 10 A. 0 R. 29 P. $168\frac{1}{2}$ sq. ft., area of field.

(6)

$(45)^2 + (60)^2 = 5625$; $\sqrt{5625} = 75$ ft. *Ans.*

(7)

$(225)^2 - (180)^2 = 18225$; $\sqrt{18225} = 135$ feet high. *Ans.*

(8)

$(65)^2 - (49)^2 = 1824$; $\sqrt{1824} = 42.708$ ft.

$(65)^2 - (39)^2 = 2704$; $\sqrt{2704} = 52$

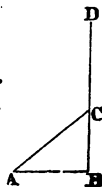
94.708 ft., width of street.

(9)

. Let BD be the height of the staff = 120 ft.

Let CA = the part broken off ; then, BC +

AC = 120 feet, and BA = 40 feet.



$$\text{Then, } AC^2 - BC^2 = AB^2 = 1600.$$

$$\text{But } AC^2 - BC^2 = (AC + BC)(AC - BC) = 1600.$$

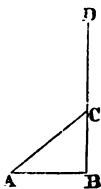
$$\text{But } AC + BC = 120 \text{ feet; hence,}$$

$$AC - BC = 1600 \div 120 = 13\frac{1}{3}$$

Since half the difference of two numbers added to half their sum gives the greater, and subtracted from it, gives the less, we have,

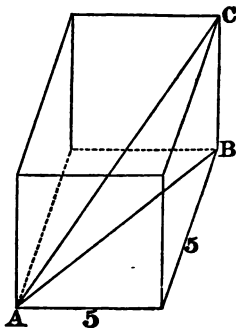
$$AC = (120 + 13\frac{1}{3}) \div 2 = 66\frac{2}{3} \text{ ft. ; and}$$

$$BC = (120 - 13\frac{1}{3}) \div 2 = 53\frac{1}{3} \text{ ft.}$$



(10)

$5^2 + 5^2 = 50$; $\sqrt{50} = 7.0716+$ = diagonal A B of base; $(7.0716+)^2 + 5^2 = 75$; $\sqrt{75} = 8.66+$ ft. = diagonal A C of the cube. *Ans.*



(11)

$$10 \times 24 \times 2 = 480; 14 \times 24 \times 2 = 672 \text{ miles.}$$

$$(480)^2 + (672)^2 = 681984; \sqrt{681984} = 825.8 \text{ miles.}$$

(12)

10 acres = 1600 sq. rd.; $\sqrt{1600} = 40$ rd., one equal side of a square; $40 \times 4 = 160$ rods, will fence the square; $160 \times 2.50 = \$400$, cost of fencing the square.

$1600 \div 4 = 400$ sq. rd., one-fourth the area of the rectangle;
 $\sqrt{400} = 20$ rods, width of rectangle; $20 \times 4 = 80$ rods,
length; $(80 \times 2) + (20 \times 2) = 200$ rods, will fence the rect-
angle; $200 \times 2.50 = \$500$, cost of fencing the rectangle;
 $500 - 400 = \$100$, difference. *Ans.*

(13)

$$1 : 9 :: 25^2 : x^2 - 5625 ; \sqrt{5625} = 75 \text{ ft. } Ans.$$

(14)

$$120 : 1500 :: 8^2 : x^2 = 800 ; \sqrt{800} = 28.28 + \text{ft. } Ans$$

(15)

$$400 : 1600 :: 3^2 : x^2 = 36 ; \sqrt{36} = 6 \text{ inches. } Ans$$

(16)

$2\frac{1}{2}$ acres = 400 sq. rd.; $400 = .7854 = 509.295923 +$;
 $\sqrt{509.295923} + = 22.567$ rd., diameter of the piece of ground;
 $22.567 \div 2 = 11.283$ rods, distance from the center to the
circumference; 4 feet = .242 + rods; $11.283 - .242 =$
11.041 rods.

(17)

The grindstone is a cylinder whose base is either of the
two side circles, and altitude the thickness of the stone.
After the first third is ground off, the remainder is a cylinder
whose altitude is the thickness of the stone, and base two-
thirds that of the largest circle; and these cylinders having
the same altitude, are to each other as their bases.

As two similar figures are to each other as the squares
of their like dimensions, two circles are to each other as the
squares of their diameters or radii; that is, the square of the
radius of the second circle will be two-thirds the square of the
largest radius, and the square of the radius of the inner circle
will be one-third the square of the largest.

Then, $(24)^2 = 576$; $576 \div 3 = 192$ sq. in. ; $576 - 192 = 384$, the square of the middle radius ; and $\sqrt{384} = 19.595 =$ the radius of what is left after the first has ground off his share ; $24 - 19.595 = 4.405$ in., the thickness of the first share.

Also, $384 - 192 = 192$; $\sqrt{192} = 13.856 +$ in., the inner radius ; $19.595 - 13.856 = 5.739$ in., the thickness of the second share ; and, 13.856, already found, is the thickness of the third share.

CUBE ROOT.

$$\begin{array}{ccc} (1) & (2) & (3) \\ \sqrt[3]{1728} = 12 \text{ A.} & \sqrt[3]{117649} = 49 \text{ A.} & \sqrt[3]{46656} = 36 \text{ A.} \end{array}$$

$$\begin{array}{cc} (4) & (5) \\ \sqrt[3]{15069223} = 247 \text{ Ans.} & \sqrt[3]{5735339} = 179 \text{ Ans.} \end{array}$$

$$\begin{array}{cc} (6) & (7) \\ \sqrt[3]{48228544} = 364 \text{ Ans.} & \sqrt[3]{84604519} = 439 \text{ Ans.} \end{array}$$

$$\begin{array}{cc} (8) & (1) \\ \sqrt[3]{28991029248} = 3072 \text{ Ans.} & \sqrt[3]{8.343} = 2.028 + \text{ Ans.} \end{array}$$

$$\begin{array}{cc} (2) & (3) \\ \sqrt[3]{1728.729} = 12.0016 + \text{ Ans.} & \sqrt[3]{.0125} = .232 + \text{ Ans.} \end{array}$$

$$\begin{array}{cc} (4) & (5) \\ \sqrt[3]{19683.46656} = 27.0002 + \text{ A.} & \sqrt[3]{.387420489} = .729 + \text{ A.} \end{array}$$

$$\begin{array}{cc} (6) & (7) \\ \sqrt[3]{.000003375} = .015 \text{ Ans.} & \sqrt[3]{.0066592} = .188 + \text{ Ans.} \end{array}$$

$$\begin{array}{c} (8) \\ \sqrt[3]{81.729} = 4.339 + \text{Ans.} \end{array}$$

$$\begin{array}{c} (1) \\ \sqrt[3]{\frac{64}{125}} = \frac{\sqrt[3]{64}}{\sqrt[3]{125}} = \frac{4}{5} \text{ Ans.} \end{array}$$

$$\begin{array}{c} (2) \\ \sqrt[3]{\frac{343}{729}} = \frac{\sqrt[3]{343}}{\sqrt[3]{729}} = \frac{7}{9} \text{ Ans} \end{array}$$

$$\begin{array}{c} (3) \\ \sqrt[3]{31\frac{1}{3}} = \frac{\sqrt[3]{10648}}{\sqrt[3]{343}} = \frac{22}{7} = 3\frac{1}{7} \end{array}$$

$$\begin{array}{c} (4) \\ \sqrt[3]{91\frac{1}{8}} = \frac{\sqrt[3]{729}}{\sqrt[3]{8}} = \frac{9}{2} = 4\frac{1}{2} \end{array}$$

$$\begin{array}{c} (5) \\ \sqrt[3]{\frac{343}{512}} = \frac{\sqrt[3]{343}}{\sqrt[3]{512}} = \frac{7}{8} \text{ Ans.} \end{array}$$

$$\begin{array}{c} (6) \\ \sqrt[3]{\frac{729}{15625}} = \frac{\sqrt[3]{729}}{\sqrt[3]{15625}} = \frac{9}{25} \text{ A.} \end{array}$$

$$\begin{array}{c} (7) \\ \sqrt[3]{\frac{19683}{262144}} = \frac{\sqrt[3]{19683}}{\sqrt[3]{262144}} = \frac{27}{64} \end{array}$$

$$\begin{array}{c} (8) \\ \sqrt[3]{\frac{13824}{42875}} = \frac{\sqrt[3]{13824}}{\sqrt[3]{42875}} = \frac{24}{35} \end{array}$$

$$\begin{array}{c} (9) \\ \sqrt[3]{7\frac{1}{2}} = \sqrt[3]{7.857142} + = 1.987 + \text{Ans.} \end{array}$$

$$\begin{array}{c} (10) \\ \sqrt[3]{56\frac{3}{5}} = \sqrt[3]{56.6} = 3.83 + \text{Ans.} \end{array}$$

$$\begin{array}{c} (1) \\ \sqrt[3]{19683} = 27 \text{ feet, each way. Ans.} \end{array}$$

$$\begin{array}{c} (2) \\ \sqrt[3]{6859} = 19 \text{ ft., length of each side;} \\ (19)^2 \times 6 = 2166 \text{ sq. ft., area of the whole surface.} \end{array}$$

K

(3)

$\sqrt[3]{46656} = 36$ ft. long ; $(36)^2 = 1296$ sq. ft., area of one side.

(4)

$150 \times 31\frac{1}{2} = 4725$ gal.; $4725 \times 231 = 1091475$ cu. in. =
 $631.640 +$ cu. ft.; $\sqrt[3]{631.640} = 8.57 +$ ft., length of one side.

(5)

$1500 \div 2 = 750$ bu. ; $750 \times 2150.4 = 1612800$ cu. in. =
 $933.333333 +$ cu. ft. ; $\sqrt[3]{933.333333 +} = 9.77 +$ ft., length
 and breadth ; $9.77 \times 2 = 19.54 +$ feet high.

(6)

27 cu. ft. $\div 2 = 13.5$ cu. ft. = half a cubic yard ;
 half a yard in length = 1.5 ft. ; $(1.5)^3 = 3.375$ cu. ft. ;
 $13.5 - 3.375 = 10.125$ cu. ft. *Ans.*

(7)

$\$911.25 = 91125$ cents ; $\sqrt[3]{91125} = 45$ cents, what he paid
 per yard ; $91125 \div 45 = 2025$, whole number of yards.

(9)

$(2.5)^3 : 5^3 :: 8 : x = 64$ pounds. *Ans.*

(10)

$1 : 8 :: 4^3 = 64 : x = 512 = 8^3$; 8 ft. length of each side.

(11)

$6^3 = 216 : (12)^3 = 1728 :: 1 : x = \frac{1728 \times 1}{216} = 8$ globes.

(12)

$$1^3 = 1 : (5.5)^3 = 166.375 :: 8 : x = 166.375 \times 8 = \$1331$$

(13)

$$100 : 800 :: 6^3 : x^3 = 1728 ; \sqrt[3]{1728} = 12 \text{ in. long.}$$

$$100 : 800 :: 3^3 : x^3 = 216 ; \sqrt[3]{216} = 6 \text{ in. wide.}$$

$$100 : 800 :: .5^3 : x^3 = 1 ; \sqrt[3]{1} = 1 \text{ in. thick. } A.$$

(14)

$$3 : 24 :: 12^3 : x^3 = 13824 ; \sqrt[3]{13824} = 24 \text{ ft. long.}$$

$$3 : 24 :: 10^3 : x^3 = 8000 ; \sqrt[3]{8000} = 20 \text{ ft. wide.}$$

$$3 : 24 :: (4.5)^3 : x^3 = 729 ; \sqrt[3]{729} = 9 \text{ ft. deep.}$$

(15)

$$2 : 16 :: 10^3 : x^3 = 8000 ; \sqrt[3]{8000} = 20 \text{ ft. } Ans.$$

(16)

The yarn will be in the form of a globe, after each of the three women has taken off her share ; these globes are to each other as the cubes of their diameters ; and as each is to have $\frac{1}{4}$ of the whole, 4, 3, 2, 1, will represent the relative sizes of these globes ;

$$4 : 3 :: 6^3 = 216 : x = (5.45+)^3 ; 5.45 = 2d \text{ diameter ;}$$

$$6 - 5.45 = .54 \text{ in., part wound off by first woman ;}$$

$$4 : 2 :: 6^3 : x = (4.76+)^3 ; 4.76 = 3d \text{ diameter ;}$$

$$.45 - 4.76 = .69 \text{ in., part wound off by second woman ;}$$

$$: 1 :: 6^3 : x = (3.77+)^3 ; 3.77 = 4th \text{ diameter ;}$$

$$4.76 - 3.77 = .99 \text{ in., part wound off by third woman ;}$$

$$3.77 + \text{ in., part which fourth woman had.}$$

ARITHMETICAL PROGRESSION.

(1)

$$(18 - 1) \times 5 = 85; 85 + 4 = 89 \text{ Ans.}$$

(2)

$$(12 - 1) \times 20 = 220; 300 - 220 = \$80 \text{ Ans.}$$

(3)

$$(15 - 1) \times 14 = 196; 196 + 200 = \$396 \text{ Ans.}$$

(4)

$$50 \times 11 = 550; 1000 + 550 = \$1550 \text{ Ans.}$$

(5)

0 = first term ;

$$\frac{1}{2} = \text{com diff. ; } (35 - 0) \times \frac{1}{2} = 17\frac{1}{2}; 17\frac{1}{2} + 0 = 17\frac{1}{2} \text{ rd.}$$

35 = No. of terms.

(6)

If he brings the farthest marble first, he will travel 300 ft., which will be the first term of a decreasing arithmetical progression, of which the number of terms is 100. Since the marbles are half a foot apart, the common difference will be 1; hence,

$300 - 99 \times 1 = 201$, the last term, or the distance he must travel to bring the nearest marble.

(1)

In this example, the first term may be taken as 0 and 16 = number of terms ;

$$75 - 0 = 75; 75 \div (16 - 1) = 5, \text{ com. diff. Ans.}$$

(2)

$$26\frac{1}{2} - \frac{1}{2} = 26; 26 \div (14 - 1) = \$2, \text{ com. diff. } \textit{Ans.}$$

(3)

$$14\frac{1}{2} - 2\frac{1}{2} = 12 \text{ in.}; 12 \div (17 - 1) = \frac{1}{2} = \frac{3}{4} \text{ in. } \textit{Ans.}$$

(4)

12 may be considered the first, and 33 the last term;

$11 - 4 = 7 =$ number of terms less 1;

$33 - 12 = 21; 21 \div 7 = 3$ com. diff.;

15, 18, 21, 24, 27, 30 are intermediate terms.

(1)

$$100 + 5 = 105; 105 \times \frac{5}{2} = \$2730 \textit{ Ans.}$$

(2)

$$(56 - 1) \times 4 = 220; 220 + 6 = 226, \text{ last term};$$

$$226 - 6 = 232; 232 \times \frac{5}{2} = \$64.96 \textit{ Ans.}$$

(3)

$$\frac{1}{4} = \text{com. diff.}; (30 - 1) \times \frac{1}{4} = 7\frac{3}{4}; 30 - 7\frac{3}{4} = 22\frac{1}{4}, \text{ last term}; 22\frac{1}{4} + 30 = 52\frac{3}{4}; 52\frac{3}{4} \times 15 = 791\frac{1}{4} \text{ miles. } \textit{Ans.}$$

(4)

6 yards = the distance of the first stone from the heap: consequently, 2×6 yards = 12 yards = the distance to bring the first stone: hence, 12 = the first term of the progression; and $1\frac{1}{4} \times 2 = 2\frac{1}{2}$ = the common difference, and 120 = the number of terms.

$$\text{Then, } 2\frac{1}{2} \times 119 + 12 = 309\frac{1}{2} = \text{last term.}$$

$$(309\frac{1}{2} + 12) \times (120 \div 2) = 321\frac{1}{2} \times 60 = 19290 \text{ yards.}$$

$$19290 \text{ yds.} = 10 \text{ mi. } 7 \text{ fur. } 27 \text{ rd. } 1\frac{1}{2} \text{ yd.}$$

(1)

$$(500 - .50) \div .09 = 5550; 5550 + 1 = 5551 \text{ bu. } \textit{Ans.}$$

(2)

$$(33 - 15) \div 1\frac{1}{2} = 12; 12 + 1 = 13, \text{ number of terms};$$

$$(33 + 15) \times (13 \div 2) = 312 \text{ miles, sum of all the terms.}$$

(3)

$$(575 - 200) \div 75 = 5; 5 + 1 = 6, \text{ number of instalments.}$$

GEOMETRICAL PROGRESSION.

(1)

$$\left(\frac{1}{2}\right)^7 = \frac{1}{2^{187}}; \frac{1}{2^{187}} \times 2^{187} = 1, \text{ last term. } Ans.$$

(2)

$$5^8 = 390625; 390625 \times 8 = 3125000 \text{ } Ans.$$

(3)

$$\left(\frac{1}{2}\right)^9 = \frac{1}{2^{513}}; \frac{1}{2^{513}} \times 2^{513} = \frac{1}{2^{513}} \text{ } Ans.$$

(4)

$$10 = \text{ratio}; (10)^{14} = 100000000000000;$$

$$100000000000000 + \$100000000000.000.$$

(5)

$$6 = \text{number of terms}; 2^5 = 32; 32 \times 100 = \$3200 \text{ } Ans.$$

(6)

His capital will treble three times in twelve years; hence,

3 = ratio, and 4 = number of terms.

$$2^3 \times 2000 = \$54000. \text{ } Ans.$$

(7)

2 = ratio, and 16 = number of terms.

$$2^{15} = 32768 \text{ cents} = \$327.68. \text{ } Ans.$$

(8)

1.06 = ratio ; \$500 = 1st term ; 4 = number of terms ;
 $1.06^3 = 1.191016$; $1.191016 \times 500 = \$595.508$ *Ans.*

(1)

$(78722 \times 3) - 4 = 236162$; $236162 \div 2 = 118081$ *Ans.*

(2)

$1024 - (4 \times \frac{1}{2}) = 1022$; $1022 \div (1 - \frac{1}{2}) = 2044$ *Ans.*

(3)

4 = ratio, and 12 = number of terms.

$4^{11} \times 2 = 8388608$, last term, or last payment.

$(8388608 \times 4) - 2 = 33554430$;

$33554430 \div (4 - 1) = \11184810 , sum of payments.

(4)

2 = ratio, and 32 = number of terms.

$(2^{31} \times 2) - 1 = 4294967295$ cents = \$42949672.95 *Ans.*

(5)

2 = ratio, and 1 the first term ;

$2^{63} \times 1 = 9223372036854775808$, last term ;

$(9223372036854775808 \times 2) - 1 = 184467440737091551615$
 grains, sum of all the terms, which divided by 7680 gives
 2401919801264264 pints, which reduced gives 37529996894754
 bushels ; this divided by 40 and 1000 gives 938249922 ships,
 and a small remainder.

ANALYSIS.

(22)

$\frac{5}{8}$ of $\frac{2}{3} = \frac{5}{12}$ part sold ; price \div quantity = cost of one ; hence,

$1736 \div \frac{5}{12} = \4166.40 value of vessel. *Ans.*

(23)

$$4\frac{2}{3} \times 7\frac{1}{8} = \frac{11}{3} \times \frac{57}{8} = \frac{627}{6} = \text{hours of travelling};$$

$$\frac{627}{6} \div 10\frac{5}{7} = \frac{627}{6} \times \frac{7}{78} = 9\frac{5}{8} \text{ days. Ans.}$$

(24)

$$\frac{1}{9} + \frac{5}{9} = \frac{17}{9} = \text{quantity in air and mud}; 1 - \frac{17}{9} = 1\frac{1}{9} \text{ quantity in water} = 2 \text{ ft.}; 2 \times 18 = 36 \text{ ft.} = \text{length of pole. Ans.}$$

(25)

$$1 - \frac{1}{4} = \frac{3}{4}, \text{ remainder}; \frac{1}{5} \text{ of } \frac{3}{4} = \frac{3}{20};$$

$$\frac{1}{4} + \frac{3}{20} = \frac{8}{20} = \frac{2}{5}, \text{ amount spent}; 1 - \frac{2}{5} = \frac{3}{5} = \$1062;$$

$$1062 \div \frac{3}{5} = \$1770 \text{ Ans.}$$

(26)

$$\text{One pipe will fill } \frac{1}{7\frac{1}{2}} = \frac{2}{15} \text{ cistern in one hour, and the other}$$

$$\text{will fill } \frac{1}{4\frac{1}{8}} = \frac{6}{25} = \text{cistern in one hour};$$

$$\frac{2}{15} + \frac{6}{25} = \frac{28}{75}, \text{ what both can fill in one hour};$$

$$1 \div \frac{28}{75} = \frac{75}{28} = 2\frac{19}{28} \text{ hr.} = \text{time for both to fill the cistern. A.}$$

(27)

$$1 \text{ yard will cost } \frac{1}{54} \text{ of } 9 = \frac{9}{54} = \frac{1}{6}; \frac{1}{6} \times 26 = \$4\frac{1}{3} \text{ Ans.}$$

$$\begin{array}{r} 13 \\ 9 \times 26 \\ \hline 54 \\ 18 \\ \hline 234 \end{array} = 13 = 4\frac{1}{3}$$

(28)

$$\frac{1}{4} \text{ of } \frac{6}{7} \text{ of } \frac{7}{9} \text{ of } \frac{\overset{25}{100}}{\underset{3}{1}} \div 2 = \frac{150}{8} = \text{cost of one acre ;}$$

$$\frac{\overset{50}{150}}{6} \times \frac{1}{2} \text{ of } \frac{3}{4} \text{ of } \frac{\overset{2}{8}}{3} = \$100 \text{ Ans.}$$

(29)

$$3\frac{1}{2} \times 1\frac{3}{8} = \frac{7}{2} \times \frac{11}{8} = \frac{77}{16} \text{ sq. yd.} = \text{sq. measure of one suit ;}$$

$$\frac{77}{16} \times \frac{1000}{1} = \frac{9625}{2} \text{ sq. yd.} = \text{square measure of 1000 suits ;}$$

$$\frac{9625}{2} \div \frac{7}{8} = \frac{9625}{2} \times \frac{8}{7} = 5500 \text{ yd. shalloon. Ans.}$$

(30)

$$8\text{s. } 9\text{d.} = 45\text{d. ; } 45 \times 234 = 10530\text{d.} = \text{value of 234 bu. ;}$$

$$10530 \div 90 = 117 \text{ lb. Ans.}$$

(31)

$$2\text{s. } 9\text{d.} = 33\text{d. ; } 33 \times 4 \times 63 \times 2 \times 3 = 49896\text{d. ;}$$

$$49896 \div 72 = \$693 \text{ Ans.}$$

(32)

$$2\text{s. } 6\text{d.} = 30\text{d. ; } 30 \times 165 = 4950\text{d.} = 4950 \div 72 = \$68.75 ;$$

$$68.75 \div 625 = \$0.11 \text{ per lb. Ans.}$$

(33)

$$3\text{s. } 4\text{d} = 40\text{d. ; } 40 \times 4 \times 7 \times 3 = 3360\text{d. : } 3360 \div 60 = \$56$$

(34)

$$10\text{s. } 8\text{d.} = 128\text{d. ; } 128 \times 22\frac{1}{2} \times 14 \times 10 = 403200\text{d.} =$$

$$\$403200 \div 72 = \$5600 \text{ Ans.}$$

(35)

$$7\frac{1}{2} \text{ cwt.} = 750 \text{ lb.} ; 12\frac{1}{2} \text{ cwt.} = 1250 \text{ lb.} ; \frac{750 \times 12}{1250} = \$0.7\frac{1}{2} \text{ A.}$$

(36)

6s. 8d. = 80d.; $80 \times 120 = 9600\text{d.} = \100 , value of the cloth

4s. 6d. = 54d.; $54 \times 76 = 4104\text{d.} = \57 , value of the rye ;

$100 - 57 = \$43$, cash to balance. *Ans.*

$$\begin{array}{r} 20 \quad 5 \quad 3 \quad 19 \\ \$0 \times 120 \quad - \quad \$4 \times 76 \\ \hline 96 \quad \quad 72 \\ \text{A} \quad \quad \text{A} \end{array} = \frac{100}{1} - \frac{57}{1} = \$43$$

(37)

$41 \times 21 = 861 \text{ yd. bought} ; 1.75 \times 861 = \1506.75 , price obtained ; $1506.75 - 1260 = \$246.75$, gain. *Ans.*

(38)

Since the hour and minute hands are together at 12, and the minute hand passes the hour hand 11 times before they are together again at 12, the minute hand will be with, and pass the hour hand between 5 and 6, in $\frac{5}{11}$ of 12 hours ;

$$\frac{5}{11} \text{ of } 12 = 5\frac{5}{11} \text{ hr.} = 5 \text{ hr. } 27 \text{ min. } 16\frac{4}{11} \text{ sec. } \textit{Ans.}$$

(39)

$(18 \times 15) \div 9 = 30 \text{ sq. yd.}$, area of the floor; $30 \div \frac{3}{4} = 40 \text{ yd.}$

(40)

If the 9 men work 1 hour a day, it will take them 12 times as long to build the house, as when they work 12 hours, viz., 60 months. If they do the same work in 6 months, they must work as many hours per day as 6 is contained times in 60 which is 10. *Ans.*

(41)

B and C do $\frac{1}{12}$ of the work in 1 day ; A, B, and C, $\frac{1}{8}$; $\frac{1}{8} - \frac{1}{12} = \frac{1}{24}$, what A will do alone in 1 day ; it will take A as many days to do the whole work as $\frac{1}{24}$ is contained times in 1 ; $1 \div \frac{1}{24} = 24$ days. *Ans.*

(42)

A can mow $\frac{1}{3}$ of the field in 1 day ; B, $\frac{1}{4}$; C, $\frac{1}{6}$ of it ; A, B, and C, can mow $\frac{1}{3} + \frac{1}{4} + \frac{1}{6} = \frac{10}{12}$ in 1 day ; $1 \div \frac{10}{12} = 1\frac{2}{5}$ days, the time it will take the three to mow it. *Ans.*

(43)

The proportional numbers are 3, 5, 7, and 9, whose sum is 24 ; the parts must be $\frac{3}{24}$, $\frac{5}{24}$, $\frac{7}{24}$ and $\frac{9}{24}$ of 480 ; $\frac{3}{24}$ of 480 = 60 ; $\frac{5}{24}$ of 480 = 100 ; $\frac{7}{24}$ of 480 = 140 ; $\frac{9}{24}$ of 480 = 180 *Ans.* Or,

$$24 : 3 :: 480 : x = 60 ; \quad 24 : 7 :: 480 : x = 140 ;$$

$$24 : 5 :: 480 : x = 100 ; \quad 24 : 9 :: 480 : x = 180.$$

(44)

A square foot is equal to 144 square inches ; the area divided by one dimension will give the other.

$$144 \div 8\frac{1}{2} = 16\frac{2}{5} \text{ inches. } \textit{Ans.}$$

(45)

At the end of 3 months there would be provisions for 1800 for 9 months = to provisions for 1 man for $9 \times 1800 = 16200$ months, and for 2400 men for $\frac{16200}{2400}$ of $6\frac{3}{4}$ months ; at the end of 4 months, the provisions would last 2400 men $2\frac{3}{4}$ months, or 1 man 6600 months ; they would last 2800 men $\frac{6600}{2800}$ of $2\frac{5}{7}$ months. *Ans.*

(46)

$$3\frac{1}{2} \times 117\frac{1}{2} = \$411.25, \text{ cost of broadcloth ;}$$

$$488.80 - 411.25 = \$77.55, \text{ cost of baize ;}$$

To every yard of broadcloth he had $\frac{1}{3}$ of $1\frac{1}{2}$ yd. of baize = $\frac{3}{10}$ yd. ; $\frac{3}{10} \times 117\frac{1}{2} = 35.25$ yd. of baize ;

$$77.55 \div 35.25 = \$2.20 \text{ per yard. } \textit{Ans.}$$

(47)

$3\frac{1}{2} \times 40 = 140$ cwt. ; $12 \times 10 = 120$ cwt. ; $\frac{1}{140}$ of $\frac{1}{2}$ = cost of transporting 1 cwt. 150 miles ;

$\frac{1}{140}$ of $\frac{1}{140}$ of $\frac{1}{2}$ = $\frac{1}{8400}$, cost of transporting 1 cwt. for 1 mile ; $\frac{1}{8400} \times 120 \times 50 = \12.00 *Ans.*

$$\frac{1}{1500} \text{ of } \frac{1}{140} \text{ of } \frac{12}{1} \times \frac{120}{1} \times \frac{50}{1} = \$12$$

(48)

50 oranges = $\frac{5}{7}$ of 84 lemons = 60 lemons ;

60 lemons are worth $2 \times 60 = 120$ cents = value of 1 lb. tea. *Ans.*

$$\frac{12}{70} \times \frac{50}{1} \times \frac{2}{1} = 120 \text{ cents} = \$1.20$$

(49)

$\$1.18\frac{2}{3}$, amount of \$1 for 2 yr. 8 mo. at 7 per cent. ;

$\$500 \div 1.18\frac{2}{3} = \$421.348+$, present value ;

$500 - 421.348 = \$78.652+$, discount. *Ans.*

(50)

The interest on \$1 for $4\frac{1}{2}$ years is $\frac{1}{225}$ of $91.12\frac{1}{2}$, and for 1 year, $\frac{1}{4\%}$ of $\frac{1}{225}$ of $91.12\frac{1}{2}$ =

$\frac{2}{9}$ of $\frac{1}{225}$ of $\frac{20.25}{2} = \$100$; and on \$640, for $2\frac{1}{4}$ yr., it will be

$$\frac{9}{100} \times \frac{\overset{8}{\cancel{640}}}{1} \times \frac{9}{4} = \$129.60 \text{ Ans.}$$

$$\frac{2}{9} \text{ of } \frac{1}{225} \text{ of } \frac{182.25}{2} \times \frac{640}{1} \times \frac{9}{4} = \$129.60$$

(51)

$1000 \times 1.75 = \$1750$, cash value; $1000 \times 1.80 = \$1800$, time value; the amount of \$1750 for 90 days, at 7 per cent., would be \$1780.625; $1800 - 1780.625 = \$19.375$. Most advantageous to sell on time.

(52)

$$1575 \div 1.045 = \$1507.177+, \text{ cash cost of goods;}$$

$$1800 - 1507.177 = \$292.823, \text{ gain. Ans.}$$

(53)

Let 1 represent C's, then $\frac{5}{6}$ would equal B's, and $\frac{2}{3}$ of $\frac{5}{6} = \frac{5}{9}$ would equal A's; $1 + \frac{5}{6} + \frac{5}{9} = \frac{24}{24} + \frac{20}{24} + \frac{15}{24} = \frac{59}{24}$, therefore they are all to have 59 shares, of which A is to have 15, B 20, and C 24; $\$482.62 \div 59 = \8.18 ; $8.18 \times 15 = \$122.70$ A's; $8.18 \times 20 = \$163.60$ B's; $8.18 \times 24 = \$196.32$ C's.

(54)

$$\frac{1}{4} + \frac{1}{2} = \frac{3}{4}, \text{ what A and B had; } 1 - \frac{3}{4} = \frac{1}{4} \text{ remainder,}$$

what C and D had ; now if C had 5 as often as D 6, then C had $\frac{5}{11}$ and D $\frac{6}{11}$ of $\frac{1}{10}$, which gives C $\frac{1}{4}$ and D $\frac{3}{10}$ of the whole. Then A must have $\frac{1}{4}$, B $\frac{1}{5}$, C $\frac{1}{4}$, and D $\frac{3}{10}$ of \$9268.60 = \$2317.15 A's ; \$1853.72 B's ; \$2317.15 C's ; \$2780.58 D's.

(55)

$5 + 5 + 7 + 8 = 25$ parts all would pay ; therefore, A paid $\frac{5}{25}$ of \$475.50 = \$95.10 ; B $\frac{5}{25} = $95.10 ; C $\frac{7}{25} = $133.14,$ and D $\frac{8}{25} = $152.16.$$

(56)

$1000 \times 16 \times 35 = 560000$ ounces, whole amount of bread ;
 $1000 + 400 = 1400$ men ; $560000 \div 1400 = 400$ ounces for
 1 man 56 days ; $400 \div 56 = 7\frac{1}{7}$ ounces per day.

(57)

The first will fill $\frac{1}{10}$ of it in 1 day ; the second $\frac{1}{8}$ in 1 day ;
 the third will empty $\frac{1}{20}$ of it in 1 day ; $\frac{1}{10} + \frac{1}{8} = \frac{13}{80}$ that
 both will fill in 1 day ; $\frac{13}{80} - \frac{1}{20} = \frac{9}{80}$, what will remain in ;
 $1 \div \frac{9}{80} = 8\frac{8}{9}$ days to fill it.

(58)

$536 \div 2 = 268$ yards distance between them ; $34 \div 3 = 11\frac{1}{3}$
 yards, the distance B goes in a minute ; $11\frac{1}{3} - 11 = \frac{1}{3}$ yards
 what B gains upon A in 1 minute. It will take him as many
 minutes to gain 268 yards, or to overtake A, as $\frac{1}{3}$ is contained
 times in 268, which will be 804 minutes, and as he travels $11\frac{1}{3}$
 yards per minute, in 804 minutes he will travel 804 times
 $11\frac{1}{3} = 9112$ yards ; $9112 \div 536 = 17$ times around the
 wood.

(59)

One man can do $\frac{1}{10}$ of the work in 1 day, the other $\frac{1}{8}$, and the boy $\frac{1}{20}$; $\frac{1}{10} + \frac{1}{8} + \frac{1}{20} = \frac{17}{80}$, and it will take them as many days to do the whole as $\frac{17}{80}$ is contained times in 1; $1 \div \frac{17}{80} = 4\frac{1}{4}$ days.

(60)

\$150 for 3 months = $150 \times 3 = \$ 450$ for 1 month ;

175 " 6 " = $175 \times 6 = 1050$ " 1 "

175 " 8 " = $175 \times 8 = 1400$ " 1 "

\$500 for various months = \$2900 for 1 month ;

\$500 will require, in order to give the same interest that \$2900 gives in one month, as many months as 500 is contained times in 2900 ; $2900 \div 500 = 5$ mo. 24 days. *Ans.*

(61)

$98\frac{3}{4} \times 7\frac{1}{2} \times 2\frac{1}{2} = \frac{395}{2} \times \frac{15}{2} \times \frac{5}{2} =$ solidity of wall in cu. ft. ;
 $\frac{1}{2}$ of $\frac{1}{20}$ of $\frac{2}{7}$ of $\frac{395}{4} \times \frac{15}{2} \times \frac{5}{2} = \frac{1975}{102816}$ cu. ft. = work done by 1 man in 1 hr. ;

$\frac{1975}{102816} \times 63 \times \frac{3}{4} = \frac{1975}{144} =$ work done by 63 men in 1 day of $11\frac{1}{3}$ hr. ;

$45\frac{1}{3} \times 6\frac{7}{12} \times 3\frac{1}{8} = \frac{136}{3} \times \frac{79}{12} \times \frac{25}{8} =$ solidity of 2d wall ;

$\frac{136}{3} \times \frac{79}{12} \times \frac{25}{8} \div \frac{1975}{144} = \frac{136}{3} \times \frac{79}{12} \times \frac{25}{8} \times \frac{144}{1975} = 68$ da.

(62)

$\frac{1}{2}$ cask = $\frac{1}{3}$ cask + 21 gal. ; hence, the difference between $\frac{1}{2}$ and $\frac{1}{3} = \frac{1}{6}$ cask = 21 gal. ; and the cask contains 6 times 21 gal. = 126 gal. *Ans.*

(63)

In this example, the simple question is, did the investment

in stocks produce a larger or smaller rate of interest than 7 per cent.: and what was the difference in the amounts?

<i>Stock.</i>	<i>Dr.</i>
Sept. 1, 1854, 10 shares, at \$115 per share,.....	\$1150
Interest on \$1150 to Jan. 1, 1856, 16 mo.	107.333
Nov. 1, 1854, 8 shares, at \$98 per share,.....	784.000
Interest on \$784 to Jan. 1, 1856, 14 mo.	64.026
April 1, 1855, 5 shares, at \$98 per share,.....	490.000
Interest on \$490 to Jan. 1, 1856, 9 mo.	25.725
Cost of stock with interest, Jan. 1, 1856,	<u>\$2621.084</u>

<i>Stock.</i>	<i>Cr.</i>
Feb. 1, 1855, dividend on 18 shares,.....	\$72.00
Interest on \$72 to Jan. 1, 1856, 11 mo.	4.62
Aug. 1, 1855, dividend on 23 shares,.....	92.00
Interest on \$92 to Jan. 1, 1856, 5 mo.	2.684
Proceeds of 23 shares of stock, at \$99,.....	<u>\$2277.000</u>
Proceeds of stock,.....	<u>\$2448.304</u>

$\$2621.084 - \$2448.304 = \$172.780$, loss by investment in stock.

(64)

He receives 91 cents on a dollar, after deducting for taxes and repairs ; therefore, \$3014.30 must be 91 per cent. of what he first receives ; $3014.30 \div 91 = \$3312.417+$. *Ans.*

(65)

$\$16.50 \div 165 = .10$ cents, the cost per pound ; $36 \times .10 = \$3.60$, the cost of 36 pounds ; $390 \times .10 = \$39$, what he must sell 390 pounds for to get the cost ; $\$39 + 3.60 = \42.60 , what he must sell it for to gain the price of 36 pounds.

(66)

$\$106 \div 10 = 40.6$ cubic yards = the volume ; the volume of a body, divided by the product of any two of its dimensions, will give the third ; $(40.6 \div 14.5) \div .7 = 4$ yd. the height.

(67)

$7 - 5 = 2$ miles, what he gains in 1 hour ; it will take him as many hours to gain 40 miles as 2 is contained times in $40 = 20$ hours ; $20 \times 7 = 140$ miles that he must travel.

(68)

The first family was equivalent to $4\frac{1}{2}$ grown persons, and the second to 9 ; $4\frac{1}{2}$ persons, in 2 weeks, would consume as much as 1 person in 9 weeks, and 9 persons, in 3 weeks, as much as 1 person in 27 weeks ; both families would consume the same as 1 person in 36 weeks ; therefore, the first must pay $\frac{2}{3} = \frac{1}{2}$ of $\$8 = \2 ; the second, $\frac{3}{4} = \frac{1}{2}$ of $\$8 = \6 .

(69)

33 A. 2 R. 16 P. = 33.6 A. ; $33.6 \times 125 = \$4200$, value of the land ; $4200 \div 42 = 100$ thousand feet of lumber.

(70)

$150 \div .03\frac{1}{2} = \4000 , amount insured, including the premium ; $150 + 25 = \$175$; $4000 - 175 = \$3825$ Ans.

(71)

$.96 \times 5000 = \$4800$, cash value of the rye ;
 $1 \times 5000 = \$5000$, credit value ; the amount of $\$4800$ for 2 months, at 7 per cent., is $\$4856$; $5000 - 4856 = \$144$, in favor of cash. Ans.

(72)

As he sold $\frac{1}{6}$ at par, he must have sold $\frac{5}{6}$ of $\frac{2}{3} = \frac{5}{9}$, capital, for \$25000; $25000 - 5000 = 20000$, par value of $\frac{5}{9}$ capital; $20000 \div \frac{5}{9} = 20000 \times \frac{9}{5} = \36000 , capital. *Ans.*

(73)

3 ft. 5 in. = 41 in.; 2 ft. 6 in. = 30 in.; 6 ft. = 72 in., $41 \times 30 \times 72 = 88560$ cubic inches = the volume of the bin; 88560, divided by 2150.4, the number of cubic inches in a bushel, gives 41.183+ bushels.

(74)

It will take the first 72 days to travel 2160 miles; the second, 80 days; and the third, 90 days; therefore, the third must start first; the second, 10 days after him; and the first 8 days after the second, or 18 days after the third.

(75)

The house did not give a profit of \$420 by \$130; $420 - 130 = \$290$, actual profit; $7180 - 290 = \$6890$, the purchase price.

(76)

The two companies consisted of 47 men; hence, the first cleared $\frac{25}{47}$, and the second $\frac{22}{47}$ of 188 acres; or the first cleared 100 acres, and the second 88 acres; as the first company contained 3 more men than the second, \$84 must be the wages of the 3 men; $\frac{1}{3}$ of 84 = \$28 = wages of 1 man; $28 \times 47 = \$1316$ = whole cost; $1316 \div 188 = \$7$ per acre. *A.*

(77)

Due Feb. 12,	\$100	$\times 42 =$	4200
" March 12,	400	$\times 70 =$	28000 .
" April 1,	300	$\times 90 =$	27000
	800		59200

$59200 \div 800 = 74$ days from Jan. 1; or, March 16.

(78)

$32 \times 25 \times 144 = 115200$ sq. in., area of the floor; $15 \times 15 = 225$ sq. in., area of a slab; $115200 \div 225 = 512$ slabs; $(32 \times 25) \div 9 = 88\frac{2}{3}$ sq. yd., area of floor; $88\frac{2}{3} \times 3.40 = \$302.22\frac{2}{3}$, whole cost.

(79)

$500 + 425 + 300 + 250 \times 175 = \1650 , amount of bequests

$1650 : 500 :: 1155 : x = \350 A's.

$1650 : 425 :: 1155 : x = \297.50 B's.

$1650 : 300 :: 1155 : x = \210 C's.

$1650 : 250 :: 1155 : x = \175 D's.

$1650 : 175 :: 1155 : x = \122.50 E's.

(80)

1 lb. tea = $\frac{7}{3}$ lb. of coffee; 1 lb. coffee = $\frac{4}{3}$ lb. sugar; 1 lb.

sug. = $\frac{7}{3}$ lb. soap; 1 lb. tea = $\frac{7}{3}$ of $\frac{12}{14}$ of $\frac{27}{18}$ lb. of soap = 12

lb.; $12 \times 6 = 72$ lb. soap. *Ans.*

(81)

Let 1 or $\frac{5}{5}$ represent the time to midnight, then $\frac{4}{5}$ will represent the time past noon, and $\frac{5}{5} + \frac{4}{5} = \frac{9}{5}$ the whole time from noon to midnight; if 12 hours be $\frac{9}{5}$, $\frac{1}{9}$ of 12 hours would be $\frac{1}{3} = \frac{1}{3}$ of 12 = $1\frac{1}{3}$ hours, $\frac{4}{5}$ of the time past noon would be 4 times $1\frac{1}{3}$ hr. = $5\frac{1}{3}$ hr. = 5 o'clock and 20 minutes, P. M.

(82)

$\frac{2}{3} \div \frac{3}{4} = \frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$ = cost of 1 yd., that is, $\frac{7}{8}$ yd. wide; $\frac{8}{9} \div \frac{7}{8} = \frac{64}{105}$ = cost of 1 yd. of the yard-wide cloth; $\frac{64}{105} \times \frac{7}{4} = \frac{16}{15} = \$1\frac{1}{3}$ = cost of 1 yd., that is, $1\frac{1}{3}$ yd. wide; $\frac{8}{9}$ of $\frac{16}{15} = \frac{128}{135} = \$0.66\frac{2}{3}$. *Ans.*

$$\frac{2}{5} \div \frac{3}{4} \div \frac{7}{8} \times \frac{7}{4} \times \frac{5}{8} = \frac{2}{5} \times \frac{4}{3} \times \frac{8}{7} \times \frac{7}{4} \times \frac{5}{8} = \frac{2}{3}.$$

(83)

If he had bought all turkeys, they would have cost him \$66 ; but as he paid only \$51.60, he saved \$14.40 by buying a part chickens ; and as he would save the difference between \$1.10 and 50 cents in buying 1 chicken, so he must buy as many chickens as 60 cents is contained times in \$14.40 = 24 chickens ; $60 - 24 = 36$ turkeys.

(84)

$6 + 4 + 3 = 13$ shillings, what he paid to them for 1 day's work ; for 104 shillings he could employ them as many days as 13 is contained times in $104 = 8$ days. *Ans.*

(85)

$5 + 6 + 7 = \$18$; then the first must have $\frac{5}{18}$, the second $\frac{6}{18}$, and the third $\frac{7}{18}$ of \$6471 : hence, \$1797.50, the first ; \$2157, the second ; and \$2516.50, the third.

(86)

$1600 + 300 = \$1900$, whole stock and gain. Now, the gain of the first will bear the same relation to the whole gain as his stock and gain do to the whole stock and gain—or $1900 : 1140 :: 300 : x = \180 , the gain of the first ; $1140 - 180 = \$960$, the stock of the first ; $1600 - 960 = \$640$, the stock of the second ; and $300 - 180 = \$120$, the gain of the second.

(87)

4.55 ft. : 75.75 ft. :: 3 ft. : x ft. = 49.945+ ft. *Ans.*

(88)

A can do $\frac{1}{3}$ of the work in 1 week ; if B can do 3 times as

much in 8 weeks, he can do A's work in $\frac{8}{3}$ of a week, and in 1 week $\frac{3}{8}$ of it; if C can do 5 times as much in 12 weeks, he can do A's work in $\frac{12}{5}$ of a week, and in 1 week $\frac{5}{12}$ of it; $\frac{1}{3} + \frac{3}{8} + \frac{5}{12} = \frac{27}{24} = \frac{9}{8}$ what all will do in 1 week; since they can do $\frac{9}{8}$ of the work in 1 week, they will do $\frac{1}{8}$ of the work in $\frac{1}{9}$ of 1 week, and to do the whole or $\frac{8}{8}$ will require 8 times $\frac{1}{9}$ of 1 week = $\frac{8}{9}$ of a week. *Ans.*

(89)

$11\frac{1}{2} \times 4 = 46$ mi.; the first is 46 mi. in advance when the second passes the point; $17\frac{1}{2} - 11\frac{1}{2} = 6$ miles, the second gains upon the first in 1 hour; it will require as many hours to overtake him as 6 is contained times in $46 = 7\frac{2}{3}$ hours; $7\frac{2}{3} + 4 = 11\frac{2}{3}$ hours, the first will travel; $11\frac{1}{2} \times 11\frac{2}{3} = 134\frac{1}{3}$ miles, the distance the first will travel.

(90)

\$120 = A's gain for 6 mo.; $120 \div 6 = \$20$, A's gain for 1 mo.

\$400 = B's gain for 12 mo.; $400 \div 12 = 833\frac{1}{3}$, B's gain for 1 mo.

\$100 = C's gain for 15 mo.; $100 \div 15 = \$6\frac{2}{3}$, C's gain for 1 mo.

$\$20 + \$33\frac{1}{3} + \$6\frac{2}{3} = \60 , entire gain for 1 month.

Now, since we have the whole gain, and the gain of each, *for the same time*; we have

$$60 : 20 :: 1600 : x = \$533\frac{1}{3} \text{ A's.}$$

$$60 : 33\frac{1}{3} :: 1600 : x = \$888\frac{2}{3} \text{ B's.}$$

$$60 : 6\frac{2}{3} :: 1600 : x = \$177\frac{1}{3} \text{ C's.}$$

$$\text{Proof, } 533\frac{1}{3} + 888\frac{2}{3} + 177\frac{1}{3} = \$1600.$$

(91)

First find the number of days, that it will take each to travel around it, by dividing the circumference by the number of miles each travels per day; it would take A $12\frac{1}{8}$, B $7\frac{3}{10}$, and C $4\frac{9}{16}$

days ; find the least common multiple of these three numbers ; thus,

$$12\frac{1}{8} \dots 7\frac{3}{10} \dots 4\frac{9}{16} = \frac{73}{240} \cdot \frac{73}{6} \cdot \frac{73}{10} \cdot \frac{73}{16}$$

$$\begin{array}{r} 5) 40 \dots 24 \dots 15 \\ 3) 8 \dots 24 \dots 3 \\ 2) 8 \dots 8 \dots 1 \\ 2) 4 \dots 4 \dots 1 \\ 2) 2 \dots 2 \dots 1 \\ 1 \dots 1 \dots 1 \end{array}$$

$$\frac{73}{240} \times 5 \times 3 \times 2 \times 2 \times 2 \times \frac{73}{2} = 36\frac{1}{2} \text{ Ans.}$$

(92)

$(2)^3 \times 1728 = 13824$ cu. in., volume of the cube ; 13824 less 10 per cent. = 12441.6 cu. in., to be drawn into wire ; $(\frac{1}{8})^2 \times 7854 = .012272$, area of the base of the cylinder of wire ; $12441.06 \div .012272 = 1013820.078 +$ inches, length of wire = 84485.006 feet.

(93)

\$10000 at 6 per cent. yields \$600. Sold out at 65 per cent., giving \$6500 : this, invested at $82\frac{1}{2}$ per cent., gives $6500 \div .825 = \$7878.787$, the interest on which, at 5 per cent., is \$393.939 ; hence, the difference, \$206.061, is in favor of the first investment.

(94)

$46\frac{1}{2} \times 8 \times 2\frac{3}{4} = 967.2$ cu. yd., what would take one boat through ; $365 - (52 + 8) = 305$ days in the year ; $40 + 40 = 80$ boats per day ; $967.2 \times 80 \times 305 = 23599680$ cu. yd. *A*

(95)

$365 \times 22 \times 64 = \513920 , whole amount of tolls ; $22 \times 5 \times 66 = \7260 , expenses ; $513920 - 7260 = \$506660$, whole tolls ; $506660 - 200000 = 306660$; $306660 \div .66 = \$4646.363$.

(96)

$$\begin{array}{r} 60 \times 48 = 2880 \\ 800 \times 43 = \underline{34400} \\ 37280 \text{ 1st.} \end{array}$$

$$\begin{array}{r} 600 \times 48 = 28800 \\ 1800 \times 42 = \underline{75600} \\ 104400 \text{ 2d.} \end{array}$$

$$\begin{array}{r} 400 \times 48 = 19200 \\ 500 \times 42 = 21000 \\ 500 \times 36 = 18000 \\ 500 \times 30 = 15000 \\ 500 \times 24 = 12000 \\ 500 \times 18 = 9000 \\ 500 \times 12 = 6000 \\ 500 \times 6 = \underline{3000} \\ 103200 \text{ 3d.} \end{array}$$

$$\begin{array}{r} 900 \times 40 = 36000 \\ 900 \times 34 = 30600 \\ 900 \times 28 = 25200 \\ 900 \times 22 = 19800 \\ 900 \times 16 = 14400 \\ 900 \times 10 = 9000 \\ 900 \times 4 = \underline{3600} \\ 138600 \text{ 4th} \end{array}$$

$$\begin{array}{r} 800 \times 48 = 38400 \\ 800 \times 36 = 28800 \\ 800 \times 24 = 19200 \\ 800 \times 12 = \underline{9600} \\ 96000 \text{ 5th.} \end{array}$$

$$\begin{array}{r} 37280 \\ 104400 \\ 103200 \\ 138600 \\ \underline{96000} \\ 479480 \text{ whole stock.} \end{array}$$

$$\begin{array}{l} 479480 : 37280 :: 20000 : x = \$1555.017 + \text{ 1st.} \\ 479480 : 104400 :: 20000 : x = \$4354.717 + \text{ 2d.} \\ 479480 : 103200 :: 20000 : x = \$4304.663 + \text{ 3d.} \\ 479480 : 138600 :: 20000 : x = \$5781.263 + \text{ 4th.} \\ 479480 : 96000 :: 20000 : x = \$4004.338 + \text{ 5th.} \end{array}$$

(97)

44 + 49 = 93, the number of men it would require to increase the square by 1 man on a side; deducting 1 for the man occupying the corner, and dividing by 2, we have the number of men on one side of the square; $(93 - 1) \div 2 = 46$; $(46)^2 = 2116$ = the number of men in the square first formed; $2116 + 44 = 2160$ men in the army.

(98)

$\frac{1}{3} + \frac{1}{4} + \frac{1}{5} = \frac{20}{60} + \frac{15}{60} + \frac{12}{60} = \frac{47}{60}$; if \$987 were divided into 47 parts, A would have 20; B, 15; and C, 12 of them, or $\frac{20}{47}$, $\frac{15}{47}$, and $\frac{12}{47}$ of \$987; by C's death, the whole is to be divided proportionally between A and B; $\frac{20}{47} + \frac{15}{47} = \frac{35}{47} = 35$ parts, of which A must have 20 and B 15; or A $\frac{20}{35} = \frac{4}{7}$, and B, $\frac{15}{35} = \frac{3}{7}$ of \$987; $\frac{4}{7}$ of 987 = \$564, A's share; $\frac{3}{7}$ of 987 = \$423, B's share. *Ans.*

(99 ,

When she left the last place she had \$3, which was $\frac{1}{2}$ a dollar less than $\frac{1}{2}$ she had when she came to the last place; then, $3\frac{1}{2}$ is one-half of 2 times $3\frac{1}{2} = \$7$, what she had when she left the second place, which was $\frac{1}{2}$ a dollar less than $\frac{1}{2}$ she had when she came to the second place; then $7\frac{1}{2}$ is one-half of 2 times $7\frac{1}{2} = \$15$, what she had when she left the first place, which was $\frac{1}{2}$ a dollar less than $\frac{1}{2}$ she had when she came to the first place; then $15\frac{1}{2}$ is one-half 2 times $15\frac{1}{2} = \$31$, what she started with.

(100)

Let 1 denote the quantity of fluid discharged by the first pipe in 4 hours, then $\frac{1}{4}$ will be the quantity discharged in 1 hour; but the quantities discharged are as the areas of their sections, and therefore as the squares of their diameters; hence,

$$6^2 : 3^2 :: \frac{1}{4} : x = \frac{1}{16},$$

what 1 of the smaller pipes will discharge in 1 hour; 4 pipes will discharge 4 times as much = $\frac{1}{4}$; therefore the 4 smaller pipes will discharge as much in 1 hour as the larger; and to discharge 2 times as much in 4 hours, would require $4 \times 2 = 8$ hours. *Ans.*

(101)

$$(370 - 40) \div (12 - 1) = \$30, \text{ common difference ;}$$

$$(370 + 40) \times 6 = \$2460, \text{ whole cost.}$$

(102)

$$15000 \div 3 = \$5000, \text{ equal payment ;}$$

$$5000 \div 1.02\frac{1}{2} = \$4885.9934 + \text{ present value ;}$$

$$5000 \div 1.035 = \$4830.9178 + \quad \quad \quad \text{“} \quad \text{“}$$

$$5000 = 1.0525 = \underline{\$4750.5938} + \quad \quad \quad \text{“} \quad \text{“}$$

$$\$14467.505 \text{ present value of purchase.}$$

(103)

$$\left. \begin{array}{r} 60 \\ 2\frac{1}{2} \\ 1\frac{1}{4} \end{array} \right\} : \left. \begin{array}{r} 84 \\ 3 \\ 2\frac{1}{4} \end{array} \right\} :: 45 : x = 97\frac{1}{2} \text{ lb.}$$

$$\frac{9}{1} \times \frac{12}{1} \times \frac{3}{1} \times \frac{9}{4} \times \frac{1}{\frac{60}{5}} \times \frac{2}{5} \times \frac{4}{7} = 97\frac{1}{2}$$

(104)

The eggs cost $\frac{1}{4}$ of a cent each, and were sold for $\frac{1}{2}$ of a cent each ; $\frac{1}{2} - \frac{1}{4} = \frac{1}{4}$, the gain on 1 egg ; $4 \div \frac{1}{4} = 80$ eggs, the number sold.

(105)

$\frac{1}{8} + \frac{1}{12} + \frac{1}{7} + \frac{1}{2} + 5 + 4$ must equal the whole length of life ; $\frac{1}{8} + \frac{1}{12} + \frac{1}{7} + \frac{1}{2} = \frac{75}{84}$, then 9 years must make up the whole ; $1 - \frac{75}{84} = \frac{9}{84}$, or the nine years of his life, from which we readily find his age to be 84 years.

(106)

Find the volumes of two cylinders, each 40 feet in length,

and one 6 ft. 6 in. in diameter, and the other 3 ft. 6 in.; the difference in volume will be the contents of the wall.

$$(42)^2 \times .7854 = 1385.4456 \text{ sq. in., area of base ;}$$

$1385.4456 \times 480 = 665013.888 + \text{cu. in.} = 384.846 \text{ cu. ft.} =$
 contents of small cylinder ; $(78)^2 \times .7854 \times 480 =$
 $2293619.3280 \text{ cu. in.} = 1327.326 \text{ cu. ft.} = \text{contents of large}$
 cylinder ;

$$1327.326 - 384.846 = 942.48 \text{ cu. ft., contents of wall.}$$

(107)

$$100 \text{ links} = 1 \text{ chain ; } 16 \text{ links} = \frac{16}{100} \text{ chain ;}$$

$$42.16 \times 37 = 1559.92 \text{ sq. ch.} = 155.992 \text{ acres} =$$

$$155 \text{ A. } 3 \text{ R. } 38.72 \text{ P. } \textit{Ans.}$$

(108)

Each annual payment is made up of two parts—interest and principal. The payment, at the end of the first year, consists of the interest on \$1500, and a certain portion of the principal, which we will call an instalment. The second annnal payment consists of the interest on the diminished principal, and a second instalment. Now, the interest on \$1500, for 1 year, plus the first instalment, is equal to the second year's interest, plus the second instalment, since each is equal to an annual payment. But the second year's interest is less than the first, by the interest on the first instalment ; therefore, the second instalment exceeds the first by this interest ; or by the .07 part of the first ; hence, the second instalment is equal to 1.07 times the first. In the same way, it may be shown, that the third is equal to the second taken 1.07 times ; or equal to the first taken 1.07×1.07 times : and the same for the other instalments. Hence, the instalments form a geometrical pro-

gression, of which the first term is the first instalment, the ratio 1.07, the number of terms 5, and the sum of the series 1500 : the first term is required :

$$\text{1st term} = \frac{1500 \times .07}{1.07^5 - 1} = 260.837 = \text{first instalment ;}$$

$$\$1500 \times .07 = \$105, \text{ first annual interest ;}$$

$$\$105 + 260.837 = \$365.837, \text{ annual payment.}$$

(109)

A, B, C will fill $\frac{1}{6}$ in 1 hour ; B, C, D, $\frac{1}{8}$; C, D, A, $\frac{1}{10}$; and D, A, B, $\frac{1}{12}$; $\frac{1}{6} + \frac{1}{8} + \frac{1}{10} + \frac{1}{12} = \frac{57}{120}$, and because the amount poured in by each pipe has been named 3 times, we divide $\frac{57}{120}$ by 3 = $\frac{19}{40}$, what the 4 pipes will fill in 1 hour ; E, F, G will empty $\frac{1}{6}$ in 1 hour ; F, G, H, $\frac{1}{8}$; G, H, E, $\frac{1}{4}$; and H, E, F, $\frac{1}{3}$; $\frac{1}{6} + \frac{1}{8} + \frac{1}{4} + \frac{1}{3} = \frac{57}{60}$, and because the amount each pipe empties is named 3 times, we divide $\frac{57}{60}$ by 3 = $\frac{19}{20}$, what the four pipes will empty in 1 hour ; $\frac{19}{40} - \frac{19}{20} = \frac{19}{40}$ of the whole fountain will be emptied in 1 hour ; it will take as many hours to empty the fountain as $\frac{19}{40}$ is contained times in 1, which is $6\frac{6}{19}$ hours.

(110)

Since the weight of similar bodies are in the same ratio as their volumes, and therefore as the cubes of their diameters, hence,

$$5 : 78.125 :: 2^3 : x^3 = 125 ; \sqrt[3]{125} = 5 \text{ inches.}$$

(111)

The divisors, which give "the present value," are what one dollar, placed at compound interest (the interest being added semi-annually), would produce from April 1st, 1853, to the times of the several payments.

Payment April 1st, 1863, without interest,	\$500.00
" " 1st, 1862, with 1 year's interest,	535.00
Present value of payment for 1864	= 466.75 +
" " " 1865	= 435.72 +
" " " 1866	= 406.75 +
" " " 1867	= 379.71 +
" " " 1868	= 354.47 +
" " " 1869	= 330.90 +
" " " 1870	= 308.89 +
" " " 1871	= 288.35 +

Present value of the bond on the 1st of April, 1863 \$4006.54 +

MENSURATION.

(2)

$$(60 \times 12) \div 2 = 360 \text{ sq. ch.}; 360 \div 10 = 36 \text{ acres.}$$

(3)

$$(45 \times 38) \div 2 = 855 \text{ sq. rd.} = 5 \text{ A. } 1 \text{ R. } 15 \text{ P. } \textit{Ans.}$$

(4)

$$(75 \times 36) \div 2 = 1350 \text{ sq. ch.} = 135 \text{ acres.}$$

(1)

$$(66.16 \times 66.16) \div 10 = 437.71456 \text{ acres} = 437 \text{ A. } 2 \text{ R. } 34 + \text{ P}$$

(2)

$$(54 \times 54) \div 10 = 291.6 \text{ acres} = 291 \text{ A. } 2 \text{ R. } 16 \text{ P. } \textit{Ans.}$$

(3)

$$75 \times 75 = 5625 \text{ sq. rd.} = 35 \text{ A. } 0 \text{ R. } 25 \text{ P. } \textit{Ans.}$$

(4)

$$80 \times 40 = 3200 \text{ sq. rd.} = 20 \text{ A. } \textit{Ans.}$$

(5)

$$80 \times 80 = 6400 \text{ sq. rd.} = 40 \text{ A. } \textit{Ans.}$$

(6)

$$(30 \times 5) \div 10 = 15 \text{ A. } \textit{Ans.}$$

(7)

$$54 \text{ ch.} \times 4 = 216 \text{ rd.}; 216 \times 18 = 3888 \text{ sq. rd.} = 24 \text{ A. } 1 \text{ R. } 8 \text{ P}$$

(8)

$$720 \text{ ft.} = 240 \text{ yd.}; 542 \times 240 = 130080 \text{ sq. yd.} = 26 \text{ A. } 3 \text{ R. } 20 \text{ P. } 5 \text{ sq. yd. } \textit{Ans.}$$

(9)

$$\text{Square measure} \div \text{length} = \text{breadth}; 24000 \div 200 = 120 \text{ ft.}$$

(2)

$$(24.82 + 16.44) \times 10.30 \div 2 = 21.2489 \text{ acres} = 21 \text{ A. } 0 \text{ R. } 39.824 \text{ P. } \textit{Ans.}$$

(3)

$$(51 + 37\frac{1}{2}) \times 20\frac{1}{2} \div 2 = 921.875 \text{ sq. ft. } \textit{Ans.}$$

(4)

$$(24.5 + 41) \times 21.5 \div 2 = 704.125 \text{ sq. yd. } \textit{Ans.}$$

(5)

$$(24.5 + 15) \times 30.80 \div 2 = 608.3 \text{ sq. ch.} = 60 \text{ A. } 3 \text{ R. } 12.8 \text{ P}$$

(6)

$$(40 + 64) \times 52 \div 2 = 2704 \text{ sq. ch.} = 270 \text{ A. } 1 \text{ R. } 24 \text{ P. } \textit{A.}$$

(2)

$$186 \times 3.1416 = 584.3376 \text{ } \textit{Ans.}$$

(3)

$$40 \times 3.1416 = 125.664 \text{ Ans.}$$

(4)

$$57 \times 3.1416 = 179.0712 \text{ Ans.}$$

(1)

$$157.08 \div 3.1416 = 50 \text{ Ans.}$$

(2)

$$23304.3888 \div 3.1416 = 7418 \text{ Ans.}$$

(3)

$$13700 \div 3.1416 = 4360.835 + \text{ Ans.}$$

(1)

$$(12)^2 \times .7854 = 113.0976 \text{ A.}$$

(2)

$$5^2 \times .7854 = 19.635 \text{ A.}$$

(3)

$$(14)^2 \times .7854 = 153.9384 \text{ Ans.}$$

(4)

$$(3.5)^2 \times .7854 \div 9 = 1.069016 + \text{ sq. yd. Ans.}$$

(5)

$$\left(\frac{1}{2}\right)^2 \times .7854 = .031416 \text{ sq. mi.} = 20 \text{ A. } 0 \text{ R. } 16.9984 \text{ P.}$$

(1)

$$6^2 \times 3.1416 = 113.076 \text{ A.}$$

(2)

$$(14)^2 \times 3.1416 = 615.7536.$$

(3)

$$(36)^2 \times 3.1416 = 4071.5136.$$

(4)

$$(7918.7)^2 \times 3.1416 = 196996571.722104 \text{ sq. mi.}$$

(2)

$$(8^2 \times 3.1416 \times 8) \div 6 = 268.0832, \text{ volume. } \textit{Ans.}$$

(3)

$$((16)^2 \times 3.1416 \times 16) \div 6 = 2144.6656, \text{ volume. } \textit{Ans.}$$

(4)

$$((7918.7)^2 \times 3.1416 \times 7918.7) \div 6 = 259992792082.63749 +$$

(5)

$$((1.2)^2 \times 3.1416 \times 1.2) \div 6 = .9047808 \text{ } \textit{Ans.}$$

(1)

$$35 \times 5 \times 52 = 9100 \text{ sq. ft.}$$

(2)

$$15 \times 8 \times 12 = 1440 \text{ sq. ft.}$$

(2)

$$48 \times 48 \times 48 = 110591 \text{ cu. in. } \textit{Ans.}$$

(3)

$$3 \text{ ft. } 2 \text{ in.} \times 2 \text{ ft. } 8 \text{ in.} \times 5 \text{ ft.} = 42\frac{2}{3} \text{ cu. ft. } \textit{Ans.}$$

(4)

$$1728 \times 42\frac{2}{3} = 72960 \text{ cu. in., volume of the cistern.}$$

$$72960 \div 231 = 315\frac{5}{7} \text{ gallons. } \textit{Ans.}$$

(5)

$$691 \times 20 = 13820 \text{ cu. ft. } \textit{Ans.}$$

(1)

$$20 \times 3.1416 \times 40 = 2513.28. \textit{Ans.}$$

(2)

$$8\frac{1}{2} \times 3.1416 \times 28 = 233.33\frac{1}{2} \text{ sq. ft. } \textit{Ans.}$$

(3)

$$15 \times 3.1416 \times 60 = 2827.44 \text{ sq. in. } \textit{Ans.}$$

(4)

$$40 \times 3.1416 \times 50 = 6283.2 \text{ sq. ft. } \textit{Ans.}$$

(2)

$$(40)^2 \times .7854 \times 29 = 36442.56 \text{ } \textit{Ans.}$$

(3)

$$(24)^2 \times .7854 \times 30 = 13571.712 \text{ } \textit{Ans.}$$

(4)

$$(32)^2 \times .7854 \times 12 = 9650.9952 \text{ } \textit{Ans.}$$

(5)

$$(25)^2 \times .7854 \times 15 = 7363.125 \text{ } \textit{Ans.}$$

(2)

$$(365 \times 36) \div 3 = 4380 \text{ } \textit{Ans.}$$

(3)

$$(207 \times 36) \div 3 = 2484 \text{ } \textit{Ans.}$$

(4)

$$(562 \times 30) \div 3 = 5620 \text{ } \textit{Ans.}$$

(5)

$$(540 \times 32) \div 3 = 5760 \text{ } \textit{Ans.}$$

(6)

$$(50 \times 24 \times 36) \div 3 = 14400 \text{ } \textit{Ans.}$$

(7)

$$(15 \times 15 \times 24) \div 3 = 1800 \text{ Ans.}$$

(2)

$$((36)^2 \times .7854 \times 27) \div 3 = 9160.9056 \text{ Ans.}$$

(3)

$$((35)^2 \times .7854 \times 27) \div 3 = 8659.035 \text{ Ans.}$$

(4)

$$((20)^2 \times .7854 \times 27) \div 3 = 2827.44 \text{ Ans.}$$

GAUGING.

(2)

$$26 \div 38 = .68\frac{5}{9}; 8551 \times 38 = 32.4938 \text{ in., mean diameter.}$$

(3)

$$22 \div 34 = 64\frac{1}{4}; 8311 \times 34 = 28.2574 \text{ in., mean diameter}$$

(1)

$$30 \div 36 = 83\frac{1}{3}; .9467 \times 36 = 34.0812;$$

$$(34.0812)^2 \times 50 \times 34 = 197.459 + \text{ gallons of wine.}$$

(2)

$$30 \div 35 = 85.7; .9556 \times 36 = 33.446, \text{ mean diameter};$$

$$(33.446)^2 \times 36 \times 34 = 136.9209 + \text{ gallons of wine};$$

$$(33.446)^2 \times 36 \times 28 = 112.7583 + \text{ gallons of beer.}$$

(3)

$$24 \div 36 = 66\frac{2}{3}; .8954 \times 36 = 32.234, \text{ mean diameter};$$

$$(32.234)^2 \times 42 \times 34 = 148.3772 + \text{ gallons of wine.}$$

L*

MECHANICAL POWERS.

(1)

$$1 : 1 :: 40 : x = 40 \text{ pounds. } \textit{Ans.}$$

(2)

The distance from the power to the fulcrum is 2 times that of the weight.

$$2 : 1 :: 50 : x = 25 \text{ pounds. } \textit{Ans.}$$

(3)

$$1 : 2 :: 25 : x = 50 \text{ pounds. } \textit{Ans.}$$

(4)

$$6 : 2 :: 60 : x = 20 \text{ pounds. } \textit{Ans.}$$

(5)

$$5 : 1 :: 200 : x = 40 \text{ pounds. } \textit{Ans.}$$

(6)

$$1 : 1 :: 1 : x = 1 \text{ in. ; } 1 \times 1\frac{1}{2} = 1\frac{1}{2} \text{ in. ;}$$

$$1 \times 2 = 2 \text{ in. ; } 1 \times 4 = 4 \text{ in. } \textit{Ans.}$$

(7)

$$5 : 8 :: 40 : x = 64 \text{ pounds. } \textit{Ans.}$$

(8)

$$8 : 12 :: 100 : x = 150 \text{ pounds. } \textit{Ans.}$$

(1)

$$60 \div 1 = 60 \text{ lb. } \textit{Ans.}$$

(2)

$$80 \div 2 = 40 \text{ lb. } \textit{Ans.}$$

$$\begin{array}{cc} (3) & (1) \\ 100 \div 4 = 25 \text{ lb.} & 40 : 600 :: 6 : x = 90 \text{ in.} = 7\frac{1}{2} \text{ ft.} \end{array}$$

$$(2) \\ 400 : 100 :: 6 : x = 1\frac{1}{2} \text{ ft. } \textit{Ans.}$$

$$(1) \\ 30 : 6 :: 200 : x = 40 \text{ pounds. } \textit{Ans.}$$

$$(2) \\ 10 : 20 :: 50 : x = 100 \text{ pounds. } \textit{Ans.}$$

$$(3) \\ 45 : 15 :: 180 : x = 60 \text{ pounds. } \textit{Ans.}$$

$$(1) \\ 2 : 12 :: 96 : x = 576 \text{ pounds. } \textit{Ans.}$$

$$(2) \\ 3 : 27 :: 250 : x = 2250 \text{ pounds. } \textit{Ans.}$$

$$(3) \\ 4\frac{1}{2} : 24 :: 200 : x = 1066\frac{2}{3} \text{ lb. } \textit{Ans.}$$

$$(4) \\ 5 : 30 :: 500 : x = 3000 \text{ } \textit{Ans.}$$

$$(1) \\ \begin{array}{ccccccc} \text{in.} & \text{ft.} & \text{in.} & \text{lb.} & & & \text{lb.} \\ \frac{1}{2} : 15 = 180 :: 720 : x = 720 \times 180 \times 2 = 259200 \text{ } \textit{A.} \end{array}$$

$$(2) \\ \begin{array}{l} 12 \text{ ft.} = \text{radius} ; 24 \text{ ft.} = \text{diameter} ; 24 \times 3.1416 \times 12 = \\ 904.7808 \text{ in.} = \text{circumference} ; \\ 904.7808 : \frac{1}{2} :: 2 \text{ tons} = 4000 \text{ lb.} : x = 1.47 + \text{ lb. } \textit{Ans.} \end{array}$$

(3)

First get the power that will produce 10000 lb. effort by the wedge; $30 : 2\frac{1}{2} :: 10000 : x = 833\frac{1}{3}$ lb. = to the weight sustained by the screw; $3.1416 \times 20 \times 12 = 753.9840$ in., circumference;

$$753.9840 : 1 :: 833\frac{1}{3} : x = 1.15 + \text{lb. } \textit{Ans.}$$

(4)

$$30 \times 3.1416 \times 12 = 1130.976, \text{ circumference;} \\ 282744 : 300 :: 1130.976 : x = 1.20 \text{ in. } \textit{Ans.}$$

QUESTIONS IN NATURAL PHILOSOPHY

(1)

$$16\frac{1}{2} + (11 \times 32\frac{1}{2}) = 369\frac{1}{2} \text{ ft} = \text{space passed in 12th sec.;} \\ 16\frac{1}{2} \times (12)^2 = 16\frac{1}{2} \times 144 = 2316 \text{ ft.} = \text{whole space. } \textit{Ans}$$

(2)

$$16\frac{1}{2} \times (15)^2 = 16\frac{1}{2} \times 225 = 3618\frac{3}{4} \text{ ft.} = \text{space passed through;} \\ 32\frac{1}{2} \times 15 = 482\frac{1}{2} \text{ ft.} = \text{acquired velocity.}$$

(3)

$$(\text{Velocity})^2 = 2 \times 32\frac{1}{2} \times \text{height of fall} = (120)^2; \text{ hence,} \\ \text{height of fall} = (120)^2 \div 2 \times 32\frac{1}{2} =$$

$$\frac{120 \times 120 \times 3}{2 \times 193} = 223\frac{161}{193} \text{ ft. } \textit{Ans.}$$

(4)

$$100 = 16\frac{1}{2} \times \text{square of time in seconds;} \\ \text{Number of seconds} = \sqrt{100 \div 16\frac{1}{2}} = \sqrt{\frac{100 \times 2}{33}} =$$

$$\sqrt{\frac{200}{33}} = \sqrt{6.0606} = 2.46 + \text{sec. } \textit{Ans.}$$

(5)

$$16\frac{1}{2} \times (10)^2 = 16\frac{1}{2} \times 100 = 1608\frac{1}{2} \text{ ft.} = \text{the space ;}$$

$$32\frac{1}{2} \times 10 = 321\frac{1}{2} \text{ ft.} = \text{the velocity. } \textit{Ans.}$$

(6)

$$(1000)^2 = 2 \times 32\frac{1}{2} \times \text{height} =$$

$$\frac{1000000 \times \overset{3}{\phi}}{2 \times 193} = 15544\frac{8}{193} \text{ ft.} = 2 \text{ mi. } 4984\frac{8}{193} \text{ ft. } \textit{Ans.}$$

(7)

$$16\frac{1}{2} \times (3.2)^2 = \text{height or depth} = 164.69\frac{1}{2} \text{ ft. } \textit{Ans.}$$

(8)

$$16\frac{1}{2} \times (2.5)^2 = \text{height} = 100.52\frac{1}{2} \text{ ft. } \textit{Ans.}$$

(9)

The question is, from what height must a body fall to acquire a velocity of 160 ft.?

$$(160)^2 = 2 \times 32\frac{1}{2} \times \text{height ; height} =$$

$$\frac{(160)^2}{2 \times 32\frac{1}{2}} = \frac{25600}{2 \times 32\frac{1}{2}} = \frac{76800}{193} = 397\frac{72}{193} ; 160 = 32\frac{1}{2} \times \text{time ;}$$

$$\text{Time} = \frac{160}{32\frac{1}{2}} = \frac{320}{193} = 4\frac{88}{193} \text{ sec. } \textit{Ans.}$$

(10)

$$5 \text{ sec.} = \text{time of ascent ; } 32\frac{1}{2} \times 5 = 160\frac{1}{2} = \text{velocity ;}$$

$$(160\frac{1}{2})^2 = 2 \times 32\frac{1}{2} \times \text{height ;}$$

$$\text{height} = \frac{(160\frac{1}{2})^2}{2 \times 32\frac{1}{2}} = \frac{931225}{2316} = 402\frac{1}{2} \text{ ft.}$$

(11)

$$\text{Height} = 16\frac{1}{2} \times (3\frac{1}{2})^2 = 193 \times \frac{1}{2} = 197\frac{1}{2} \text{ ft. } \textit{Ans.}$$

(12)

$$2500 = 32\frac{1}{8} \times \text{time}; \text{time} = \frac{2500}{32\frac{1}{8}} = \frac{15000}{193} = 77\frac{32}{193} \text{ sec. } A.$$

(13)

$$(350)^2 = 2 \times 32\frac{1}{8} \times \text{height};$$

$$\text{height} = \frac{(350)^2}{2 \times 32\frac{1}{8}} = \frac{367500}{193} = 1904\frac{28}{193} \text{ ft.};$$

$$350 = 32\frac{1}{8} \times \text{time}; \text{time} = \frac{350}{32\frac{1}{8}} = \frac{2100}{193} = 10\frac{170}{193} \text{ sec. } A.$$

(14)

$$3040 = 32\frac{1}{8} \times \text{time}; \text{time} = \frac{3040}{32\frac{1}{8}} = \frac{18240}{193} = 94\frac{98}{193} \text{ sec.}$$

(15)

$$\text{Velocity} = 32\frac{1}{8} \times 45 = 1447\frac{1}{8} \text{ ft.}$$

(16)

$$1970 = 32\frac{1}{8} \times \text{time}; \text{time} = \frac{1970}{32\frac{1}{8}} = \frac{11820}{193} = 61.24 + \text{ sec.}$$

(17)

$$3280 = 16\frac{1}{12} \times (\text{time})^2; (\text{time})^2 = \frac{3280}{16\frac{1}{12}};$$

$$\text{time} = \sqrt{\frac{3280}{16\frac{1}{12}}} = \sqrt{203.93777+} = 14.28 + \text{ sec. } Ans.$$

(18)

$$(984)^2 = 2 \times 32\frac{1}{8} \times \text{height};$$

$$\text{height} = \frac{(984)^2}{2 \times 32\frac{1}{8}} = \frac{2904768}{193} = 15050\frac{118}{193} \text{ ft.}$$

(19)

$$386 = 32\frac{1}{2} \times \text{time}; \text{time} = \frac{386}{32\frac{1}{2}} = \frac{2316}{193} = 12 \text{ sec.};$$

$$\text{height} = 16\frac{1}{12} \times (12)^2 = \frac{192}{12} \times 12 \times 12 = 2316 \text{ ft.}$$

(1)

$$93 - 82\frac{1}{2} = 10.5 \text{ gr., weight of an equal volume of water.}$$

$$93 \div 10.5 = 8.857 = \text{specific gravity.}$$

(2)

A cubic foot of the oak must weigh 925 ounces. Therefore,
 925 oz. : 2240 × 16 oz. :: 1 cubic foot : $38\frac{1}{4}\frac{3}{4}$ cubic feet.

(3)

The compound weighs in air $50 + 390 = 440$ oz. The weight of an equal volume of water is $440 - 344 = 96$ oz. The weight of a volume of water equal to volume of the copper is $390 - 345 = 45$ oz. Therefore, weight of volume of water equal to volume of the wax is $96 - 45 = 51$ oz. Specific gravity of the pumice stone = $50 \div 51 = .980$.

(4)

Since the weight of the ice and of the displaced water are equal, we have $20.45 \times 15.75 \times 10.5 \times .930 = 20.45 \times 15.75 \times \text{height of displaced prism of water} \times 1.026$. Then, by cancelling, $10.5 \times .930 = \text{height} \times 1.026$; hence, $\text{height} = 10.5 \times .930 \div 1.026 = 9.517$ yd. Therefore, $10.5 - 9.517 = 953$ yd. = height of ice above the surface = 2 ft. 11.383 in.

(5)

$$6043 \times 63 = 380709 \text{ lb.} = 190 \text{ T. } 709 \text{ lb.} = \text{weight of vessel.}$$

(6)

$$33 - 21 = 12 = \text{weight of an equal volume of water.}$$

$$33 \div 12 = 2.75 = \text{specific gravity.}$$

(7)

$$17 \div 2.35 = 7.234 = \text{specific gravity.}$$

(8)

$$250 \div 318 = .786 = \text{specific gravity of the alcohol.}$$

(9)

$$14 - 8 = 6 = \text{weight of water; } 13.25 - 8 = 5.25 = \text{weight of brandy; } 5.25 \div 6 = .875 = \text{specific gravity.}$$

(10)

$$2.837 \times 1000 = 2837 \text{ oz.} = 177 \text{ lb. } 5 \text{ oz}$$

(11)

$$36.4 \div 33 = 1.103 = \text{specific gravity.}$$

MARIOTTE'S LAW.

(1)

$$12.3 \text{ lb.} : 10 \text{ lb.} :: 4.3 \text{ qt.} : 3.49 \text{ qt.}$$

(2)

$$8 \text{ qt.} : 20 \text{ qt.} :: 15 \text{ lb.} : 37.5 \text{ lb.}$$

(3)

The density being directly proportional to the pressure, we have,

$$15 \text{ lb.} : 14.2 \text{ lb.} :: 2.6 \text{ gr.} : 2.46 \text{ gr.}$$

The density being diminished, the weight is diminished in the same proportion.

(4)

$$47 \text{ lb.} : 25 \text{ lb.} :: 1 : .5319.$$

THE NATIONAL SERIES OF READERS.

COMPLETE IN TWO INDEPENDENT PARTS.

I.

THE NATIONAL READERS.

By PARKER & WATSON.

No. 1.—National Primer,	64 pp., 16mo,	\$0 25
No. 2.—National First Reader,	128 pp., 16mo,	38
No. 3.—National Second Reader, . . .	224 pp., 16mo,	63
No. 4.—National Third Reader,	288 pp., 12mo,	1 00
No. 5.—National Fourth Reader, . . .	432 pp., 12mo,	1 50
No. 6.—National Fifth Reader,	600 pp., 12mo,	1 88
<hr/>		
National Elementary Speller,	160 pp., 16mo,	25
National Pronouncing Speller,	188 pp., 12mo,	50

II.

THE INDEPENDENT READERS.

By J. MADISON WATSON.

The Independent First Reader,	80 pp., 16mo,	25
The Independent Second Reader,	160 pp., 16mo,	50
The Independent Third Reader,	240 pp., 16mo,	75
The Independent Fourth Reader,	264 pp., 12mo,	1 00
The Independent Fifth Reader,	336 pp., 12mo,	1 25
The Independent Sixth Reader,	474 pp., 12mo,	1 50
<hr/>		
The Independent Child's Speller (Script),	80 pp., 16mo,	25
The Independent Youth's Speller (Script),		—
The Independent Spelling Book,	160 pp., 16mo,	25

. The Readers constitute two complete and entirely distinct series, either of which is adequate to every want of the best schools. The Spellers may accompany either Series.

PARKER & WATSON'S NATIONAL READERS.

The salient features of these works which have combined to render them so popular may be briefly recapitulated as follows :

1. **THE WORD-BUILDING SYSTEM.**—This famous progressive method for young children originated and was copyrighted with these books. It constitutes a process with which the beginner with *words* of one letter is gradually introduced to additional lists formed by prefixing or affixing single letters, and is thus led almost insensibly to the mastery of the more difficult constructions. This is one of the most striking modern improvements in methods of teaching.

2. **TREATMENT OF PRONUNCIATION.**—The wants of the youngest scholars in this department are not overlooked. It may be said that from the first lesson the student by this method need never be at a loss for a prompt and accurate rendering of every word encountered.

3. **ARTICULATION AND ORTHOEPIY** are considered of primary importance.

4. **PUNCTUATION** is inculcated by a series of interesting *reading lessons*, the simple perusal of which suffices to fix its principles indelibly upon the mind.

5. **ELOCUTION.** Each of the higher Readers (3d, 4th and 5th) contains elaborate, scholarly, and thoroughly practical treatises on elocution. This feature alone has secured for the series many of its warmest friends.

6. **THE SELECTIONS** are the crowning glory of the series. Without exception it may be said that no volumes of the same size and character contain a collection so diversified, judicious, and artistic as this. It embraces the choicest gems of English literature, so arranged as to afford the reader ample exercise in every department of style. So acceptable has the taste of the authors in this department proved, not only to the educational public but to the reading community at large, that thousands of copies of the Fourth and Fifth Readers have found their way into public and private libraries throughout the country, where they are in constant use as manuals of literature, for reference as well as perusal.

7. **ARRANGEMENT.** The exercises are so arranged as to present constantly alternating practice in the different styles of composition, while observing a definite plan of progression or gradation throughout the whole. In the higher books the articles are placed in formal sections and classified topically, thus concentrating the interest and inculcating a principle of association likely to prove valuable in subsequent general reading.

8. **NOTES AND BIOGRAPHICAL SKETCHES.** These are full and adequate to every want. The biographical sketches present in pleasing style the history of every author laid under contribution.

9. **ILLUSTRATIONS.** These are plentiful, almost profuse, and of the highest character of art. They are found in every volume of the series as far as and including the Third Reader.

10. **THE GRADATION** is perfect. Each volume overlaps its companion preceding or following in the series, so that the scholar, in passing from one to another, is only conscious, by the presence of the new book, of the transition.

11. **THE PRICE** is reasonable. The National Readers contain more matter than any other series in the same number of volumes published. Considering their completeness and thoroughness they are much the cheapest in the market.

12. **BINDING.** By the use of a material and process known only to themselves, in common with all the publications of this house, the National Readers are warranted to outlast any with which they may be compared—the ratio of relative durability being in their favor as two to one.

WATSON'S INDEPENDENT READERS.

This Series is designed to meet a general demand for smaller and cheaper books than the National Series proper, and to serve as well for intermediate volumes of the National Readers in large graded schools requiring more books than one ordinary series will supply.

Beauty. The most casual observer is at once impressed with the unparalleled mechanical beauty of the Independent Readers. The Publishers believe that the æsthetic tastes of children may receive no small degree of cultivation from their very earliest school books, to say nothing of the importance of making study attractive by all such artificial aids that are legitimate. In accordance with this view, not less than \$25,000 was expended in their preparation before publishing, with a result which entitles them to be considered "The Perfection of Common School Books."

Selections. They contain, of course, none but entirely new selections. These are arranged according to a strictly progressive and novel method of developing the elementary sounds in order in the lower numbers, and in all, with a view to topics and general literary style. The mind is thus led in fixed channels to proficiency in every branch of good reading, and the evil results of 'scattering' as practised by most school-book authors, avoided.

The Illustrations, as may be inferred from what has been said, are elegant beyond comparison. They are profuse in every number of the series from the lowest to the highest. This is the only series published of which this is true.

The Type is semi-phonetic, the invention of Prof. Watson. By it every letter having more than one sound is clearly distinguished in all its variations without in any way mutilating or disguising the normal form of the letter.

Elocution is taught by prefatory treatises of constantly advancing grade and completeness in each volume, which are illustrated by wood-cuts in the lower books, and by black-board diagrams in the higher. Prof. Watson is the first to introduce Practical Illustrations and Black-board Diagrams for teaching this branch.

Foot Notes on every page afford all the incidental instruction which the teacher is usually required to impart. Indices of words refer the pupil to the place of their first use and definition. The Biographies of Authors and others are in every sense excellent.

Economy. Although the number of pages in each volume is fixed at the minimum, for the purpose recited above, the utmost amount of matter available without overcrowding is obtained in the space. The pages are much wider and larger than those of any competitor and contain *twenty per cent* more matter than any other series of the same type and number of pages.

All the Great Features. Besides the above all the popular features of the National Readers are retained except the Word-Building system. The latter gives place to an entirely new method of progressive development, based upon some of the best features of the Word System, Phonetics and Object Lessons.

NATIONAL READERS.

ORIGINAL AND "INDEPENDENT" SERIES.

SPECIMEN TESTIMONIALS.

From D. H. HARRIS, Supt. Public Schools, Hannibal, Mo.

The National Series of Readers are now in use in our public schools, and I regard them *the best* that I have ever examined or used.

From HON. J. K. JILLSON, Supt. of Education, State of South Carolina.

I have carefully examined your new and beautiful Series of Readers known as "The Independent Readers," and do not hesitate to recommend it as the finest and most excellent ever presented to the public.

From D. N. ROOK, Sec. of School Board, Williamsport, Pa.

I would say that Parker & Watson's Series of Readers and Spellers give the best satisfaction in our schools of any Series of Readers and Spellers that have ever been used. There is nothing published for which we would exchange them.

From PROF. H. SEELE, New Braunfels Academy, Texas.

I recommend the National Readers for four good reasons: (1.) The printing, engraving, and binding is excellent. (2.) They contain choice selections from English Literature. (3.) They inculcate good morals without any sectarian bias. (4.) They are truly *National*, because they teach pure patriotism and not sectional prejudice.

From S. FINDLEY, Supt. Akron Schools, Ohio.

We use no others, and have no desire to. They give entire satisfaction. We like the freshness and excellence of the selections. We like the biographical notes and the definitions at the foot of the page. We also like the white paper and clear and beautiful type. In short, we do not know where to look for books which would be so satisfactory both to teachers and pupils.

From PRES. ROBERT ALLYN, McKendree College, Ill.

Since my connection with this college, we have used in our preparatory department the Series of Readers known as the "National Readers," compiled by Parker & Watson, and published by Messrs. A. S. Barnes & Co. They are *excellent*; afford choice selections; contain the right system of elocutionary instruction, and are well printed and bound so as to be serviceable as well as interesting. I can commend them as among the excellent means used by teachers to make their pupils proficient in that noblest of school arts, GOOD READING.

From W. T. HARRIS, Supt. Public Schools, St. Louis, Mo.

I have to admire these excellent selections in prose and verse, and the careful arrangement which places first what is easy of comprehension, and proceeds gradually to what is difficult. I find the lessons so arranged as to bring together different treatments of the same topic, thereby throwing much light on the pupil's path, and I doubt not adding greatly to his progress. The proper variety of subjects chosen, the concise treatise on elocution, the beautiful typography and substantial binding—all these I find still more admirable than in the former series of National Readers, which I considered *models* in these respects.

From H. T. PHILLIPS, Esq., of the Board of Education, Atlanta, Ga.

The Board of Education of this city have selected for use in the public schools of Atlanta the entire series of your Independent Readers, together with Steele's (Chemistry and Philosophy. As a member of the Board, and of the Committee on Text-books, the subject of Readers was referred to me for examination. I gave a pretty thorough examination to ten (10) different series of Readers, and in endeavoring to arrive at a decision upon the sole question of merit, and entirely independent of any extraneous influence, I very cordially recommended the Independent Series. This verdict was approved by the Committee and adopted by the Board.

From Report of REV. W. T. BRANTLY, D.D., late Professor of Belles Lettres, University of Georgia, on "Text-Books in Reading," before the Teachers' Convention of Georgia, May 4, 1870.

The *National Series*, by Parker & Watson, is deserving of its high reputation. The Primary Books are suited to the weakest capacity; whilst those more advanced supply instructive illustration on all that is needed to be known in connection with the art.

WATSON'S CHILD'S SPELLER.

THE INDEPENDENT CHILD'S SPELLER.

Price 25 Cents.

This unique book, published in 1872, is the first to be consistently printed in imitation of writing; that is, it teaches orthography as we use it. It is for the smallest class of learners, who soon become familiarized with words by their forms, and learn to read writing while they spell.

EXTRACT FROM THE PREFACE.

Success in teaching English orthography is still exceptional, and it must so continue until the principles involved are recognized in practice. Form is foremost: the eye and the hand must be trained to the formation of words; and since spelling is a part of writing, the written form only should be used. The laws of mental association, also—especially those of resemblance, contrast, and contiguity in time and place—should receive such recognition in the construction of the text-book as shall insure, whether consciously or not, their appropriate use and legitimate results. Hence, the spelling-book, properly arranged, is a necessity from the first; and, though primers, readers, and dictionaries may serve as aids, it can have no competent substitute.

Consistently with these views, the words used in the Independent Child's Speller have such original classifications and arrangements in columns—in reference to location, number of letters, vowel sounds, alphabetic equivalents, and consonant terminations—as exhibit most effectively their formation and pronunciation. The vocabulary is strictly confined to the simple and significant monosyllables in common use. He who has mastered these may easily learn how to spell and pronounce words of more than one syllable.

The introduction is an illustrated alphabet in script, containing twenty-six pictures of objects, and their names, commencing both with capitals and small letters. Part First embraces the words of one, two, and three letters; Part Second, the words of four letters; and Part Third, other monosyllables. They are divided into short lists and arranged in columns, the vowels usually in line, so as to exhibit individual characteristics and similarity of formation. The division of words into paragraphs is shown by figures in the columns. Each list is immediately followed by sentences for reading and writing, in which the same words are again presented with irregularities of form and sound. Association is thus employed, memory tested, and definition most satisfactorily taught.

Among the novel and valuable features of the lessons and exercises, probably the most prominent are their adaptedness for young children and their being printed in exact imitation of writing. The author believes that hands large enough to spin a top, drive a hoop, or catch a ball, are not too small to use a crayon, or a slate and pencil; that the child's natural desire to draw and write should not be thwarted, but gratified, encouraged, and wisely directed; and that since the written form is the one actually used in connection with spelling in after-life, the eye and the hand of the child should be trained to that form from the first. He hopes that this little work, designed to precede all other spelling-books and conflict with none, may satisfy the need so universally recognized of a fit introduction to orthography, penmanship, and English composition.

The National Readers and Spellers.

THEIR RECORD.

These books have been adopted by the School Boards, or official authority, of the following important States, cities, and towns—in most cases for exclusive use

The State of Minnesota.

The State of Texas.

The State of Missouri.

The State of Alabama.

The State of North Carolina.

The State of Louisiana.

New York.

New York City.
Brooklyn.
Buffalo.
Albany.
Rochester.
Troy.
Syracuse.
Elmira.
&c., &c.

Illinois.

Chicago.
Peoria.
Alton.
Springfield.
Aurora.
Galesburg.
Rockford.
Rock Island.
&c., &c.

Indiana.

New Albany.
Fort Wayne.
Lafayette.
Madison.
Logansport.
Indianapolis.

Pennsylvania.

Reading.
Lancaster.
Erie.
Scranton.
Carlisle.
Carbondale.
Westchester.
Schuylkill Haven.
Williamsport.
Norristown.
Bellefonte.
Wilkesbarre.
&c., &c.

Wisconsin.

Milwaukee.
Fond du Lac.
Oshkosh.
Janesville.
Racine.
Watertown.
Sheboygan.
La Crosse.
Waukesha.
Kenosha.
&c., &c.

Iowa.

Davenport.
Burlington.
Muscatine.
Mount Pleasant.
&c.

Nebraska.

Brownsville.
Lincoln.
&c.

Oregon.

Portland.
Salem.
&c.

New Jersey.

Newark.
Jersey City.
Paterson.
Trenton.
Camden.
Elizabeth.
New Brunswick.
Phillipsburg.
Orange.
&c., &c.

Michigan.

Grand Rapids.
Kalamazoo.
Adrian.
Jackson.
Molroe.
Lansing.
&c., &c.

Virginia.

Richmond.
Norfolk.
Petersburg.
Lynchburg.
&c.

Delaware.

Wilmington.

D. C.

Washington.

Ohio.

Toledo.
Sandusky.
Conneaut.
Chardon.
Hudson.
Canton.
Salem.
&c., &c.

Georgia.
Savannah.

Louisiana.
New Orleans.

Tennessee.
Memphis

The Educational Bulletin records periodically all new points gained.

SCHOOL-ROOM CARDS.

Baade's Reading Case, *\$10 00

A frame containing movable cards, with arrangement for showing one sentence at a time, capable of 28,000 transpositions.

Eureka Alphabet Tablet *\$1 50

Presents the alphabet upon the Word Method System, by which the child will learn the alphabet in nine days, and make no small progress in reading and spelling in the same time.

National School Tablets, 10 Nos. *\$8 00

Embrace reading and conversational exercises, object and moral lessons, form, color, &c. A complete set of these large and elegantly illustrated Cards will embellish the school-room more than any other article of furniture.

READING.

Fowle's Bible Reader. \$1 00

The narrative portions of the Bible, chronologically and topically arranged, judiciously combined with selections from the Psalms, Proverbs, and other portions which inculcate important moral lessons or the great truths of Christianity. The embarrassment and difficulty of reading the Bible itself, by course, as a class exercise, are obviated, and its use made feasible, by this means.

North Carolina First Reader 40

North Carolina Second Reader 65

North Carolina Third Reader 1 00

Prepared expressly for the schools of this State, by C. H. Wiley, Superintendent of Common Schools, and F. M. Hubbard, Professor of Literature in the State University.

Parker's Rhetorical Reader. 1 00

Designed to familiarize Readers with the pauses and other marks in general use, and lead them to the practice of modulation and inflection of the voice.

Introductory Lessons in Reading and Elocution 75

Of similar character to the foregoing, for less advanced classes.

High School Literature. 1 50

Admirable selections from a long list of the world's best writers, for exercise in reading, oratory, and composition. Speeches, dialogues, and model letters represent the latter department.

(7)

$$17 \div 2.35 = 7.234 = \text{specific gravity.}$$

(8)

$$250 \div 318 = .786 = \text{specific gravity of the alcohol.}$$

(9)

$$14 - 8 = 6 = \text{weight of water; } 13.25 - 8 = 5.25 = \text{weight of brandy; } 5.25 \div 6 = .875 = \text{specific gravity.}$$

(10)

$$2.837 \times 1000 = 2837 \text{ oz.} = 177 \text{ lb. } 5 \text{ oz}$$

(11)

$$36.4 \div 33 = 1.103 = \text{specific gravity.}$$

MARIOTTE'S LAW.

(1)

$$12.3 \text{ lb.} : 10 \text{ lb.} :: 4.3 \text{ qt.} : 3.49 \text{ qt.}$$

(2)

$$8 \text{ qt.} : 20 \text{ qt.} :: 15 \text{ lb.} : 37.5 \text{ lb.}$$

(3)

The density being directly proportional to the pressure, we have,

$$15 \text{ lb.} : 14.2 \text{ lb.} :: 2.6 \text{ gr.} : 2.46 \text{ gr.}$$

The density being diminished, the weight is diminished in the same proportion.

(4)

$$47 \text{ lb.} : 25 \text{ lb.} :: 1 : .5319.$$

THE NATIONAL SERIES OF READERS.

COMPLETE IN TWO INDEPENDENT PARTS.

I.

THE NATIONAL READERS.

By PARKER & WATSON.

No. 1.—National Primer,	64 pp., 16mo,	\$0 25
No. 2.—National First Reader,	128 pp., 16mo,	38
No. 3.—National Second Reader, . . .	224 pp., 16mo,	63
No. 4.—National Third Reader,	288 pp., 12mo,	1 00
No. 5.—National Fourth Reader, . . .	432 pp., 12mo,	1 50
No. 6.—National Fifth Reader,	600 pp., 12mo,	1 88
<hr/>		
National Elementary Speller,	160 pp., 16mo,	25
National Pronouncing Speller,	188 pp., 12mo,	50

II.

THE INDEPENDENT READERS.

By J. MADISON WATSON.

The Independent First Reader,	80 pp., 16mo,	25
The Independent Second Reader, . . .	160 pp., 16mo,	50
The Independent Third Reader,	240 pp., 16mo,	75
The Independent Fourth Reader, . . .	264 pp., 12mo,	1 00
The Independent Fifth Reader,	336 pp., 12mo,	1 25
The Independent Sixth Reader,	474 pp., 12mo,	1 50
<hr/>		
The Independent Child's Speller (Script),	80 pp., 16mo,	25
The Independent Youth's Speller (Script),		—
The Independent Spelling Book,	160 pp., 16mo,	25

. The Readers constitute two complete and entirely distinct series, either of which is adequate to every want of the best schools. The Spellers may accompany either Series.

PARKER & WATSON'S NATIONAL READERS.

The salient features of these works which have combined to render them so popular may be briefly recapitulated as follows :

1. **THE WORD-BUILDING SYSTEM.**—This famous progressive method for young children originated and was copyrighted with these books. It constitutes a process with which the beginner with *words* of one letter is gradually introduced to additional lists formed by prefixing or affixing single letters, and is thus led almost insensibly to the mastery of the more difficult constructions. This is one of the most striking modern improvements in methods of teaching.

2. **TREATMENT OF PRONUNCIATION.**—The wants of the youngest scholars in this department are not overlooked. It may be said that from the first lesson the student by this method need never be at a loss for a prompt and accurate rendering of every word encountered.

3. **ARTICULATION AND ORTHOEPY** are considered of primary importance.

4. **PUNCTUATION** is inculcated by a series of interesting *reading lessons*, the simple perusal of which suffices to fix its principles indelibly upon the mind.

5. **ELOCUTION.** Each of the higher Readers (3d, 4th and 5th) contains elaborate, scholarly, and thoroughly practical treatises on elocution. This feature alone has secured for the series many of its warmest friends.

6. **THE SELECTIONS** are the crowning glory of the series. Without exception it may be said that no volumes of the same size and character contain a collection so diversified, judicious, and artistic as this. It embraces the choicest gems of English literature, so arranged as to afford the reader ample exercise in every department of style. So acceptable has the taste of the authors in this department proved, not only to the educational public but to the reading community at large, that thousands of copies of the Fourth and Fifth Readers have found their way into public and private libraries throughout the country, where they are in constant use as manuals of literature, for reference as well as perusal.

7. **ARRANGEMENT.** The exercises are so arranged as to present constantly alternating practice in the different styles of composition, while observing a definite plan of progression or gradation throughout the whole. In the higher books the articles are placed in formal sections and classified topically, thus concentrating the interest and inculcating a principle of association likely to prove valuable in subsequent general reading.

8. **NOTES AND BIOGRAPHICAL SKETCHES.** These are full and adequate to every want. The biographical sketches present in pleasing style the history of every author laid under contribution.

9. **ILLUSTRATIONS.** These are plentiful, almost profuse, and of the highest character of art. They are found in every volume of the series as far as and including the Third Reader.

10. **THE GRADATION** is perfect. Each volume overlaps its companion preceding or following in the series, so that the scholar, in passing from one to another, is only conscious, by the presence of the new book, of the transition.

11. **THE PRICE** is reasonable. The National Readers contain more matter than any other series in the same number of volumes published. Considering their completeness and thoroughness they are much the cheapest in the market.

12. **BINDING.** By the use of a material and process known only to themselves, in common with all the publications of this house, the National Readers are warranted to outlast any with which they may be compared—the ratio of relative durability being in their favor as two to one.

WATSON'S INDEPENDENT READERS.

This Series is designed to meet a general demand for smaller and cheaper books than the National Series proper, and to serve as well for intermediate volumes of the National Readers in large graded schools requiring more books than one ordinary series will supply.

Beauty. The most casual observer is at once impressed with the unparalleled mechanical beauty of the Independent Readers. The Publishers believe that the aesthetic tastes of children may receive no small degree of cultivation from their very earliest school books, to say nothing of the importance of making study attractive by all such artificial aids that are legitimate. In accordance with this view, not less than \$25,000 was expended in their preparation before publishing, with a result which entitles them to be considered "The Perfection of Common School Books."

Selections. They contain, of course, none but entirely new selections. These are arranged according to a strictly progressive and novel method of developing the elementary sounds in order in the lower numbers, and in all, with a view to topics and general literary style. The mind is thus led in fixed channels to proficiency in every branch of good reading, and the evil results of 'scattering' as practised by most school-book authors, avoided.

The Illustrations, as may be inferred from what has been said, are elegant beyond comparison. They are profuse in every number of the series from the lowest to the highest. This is the only series published of which this is true.

The Type is semi-phonetic, the invention of Prof. Watson. By it every letter having more than one sound is clearly distinguished in all its variations without in any way mutilating or disguising the normal form of the letter.

Elocution is taught by prefatory treatises of constantly advancing grade and completeness in each volume, which are illustrated by wood-cuts in the lower books, and by black-board diagrams in the higher. Prof. Watson is the first to introduce Practical Illustrations and Black-board Diagrams for teaching this branch.

Foot Notes on every page afford all the incidental instruction which the teacher is usually required to impart. Indices of words refer the pupil to the place of their first use and definition. The Biographies of Authors and others are in every sense excellent.

Economy. Although the number of pages in each volume is fixed at the minimum, for the purpose recited above, the utmost amount of matter available without overcrowding is obtained in the space. The pages are much wider and larger than those of any competitor and contain *twenty per cent* more matter than any other series of the same type and number of pages.

All the Great Features. Besides the above all the popular features of the National Readers are retained except the Word-Building system. The latter gives place to an entirely new method of progressive development, based upon some of the best features of the Word System, Phonetics and Object Lessons.

NATIONAL READERS.

ORIGINAL AND "INDEPENDENT" SERIES.

SPECIMEN TESTIMONIALS.

From D. H. HARRIS, Supt. Public Schools, Hannibal, Mo.

The National Series of Readers are now in use in our public schools, and I regard them *the best* that I have ever examined or used.

From HON. J. K. JILLSON, Supt. of Education, State of South Carolina.

I have carefully examined your new and beautiful Series of Readers known as "The Independent Readers," and do not hesitate to recommend it as the finest and most excellent ever presented to the public.

From D. N. ROOK, Sec. of School Board, Williamsport, Pa.

I would say that Parker & Watson's Series of Readers and Spellers give the best satisfaction in our schools of any Series of Readers and Spellers that have ever been used. There is nothing published for which we would exchange them.

From PROF. H. SEELE, New Braunfels Academy, Texas.

I recommend the National Readers for four good reasons: (1) The printing, engraving, and binding is excellent. (2) They contain choice selections from English Literature. (3) They inculcate good morals without any sectarian bias. (4) They are truly *National*, because they teach pure patriotism and not sectional prejudice.

From S. FINDLEY, Supt. Akron Schools, Ohio.

We use no others, and have no desire to. They give entire satisfaction. We like the freshness and excellence of the selections. We like the biographical notes and the definitions at the foot of the page. We also like the white paper and clear and beautiful type. In short, we do not know where to look for books which would be so satisfactory both to teachers and pupils.

From PRES. ROBERT ALLYN, McKendree College, Ill.

Since my connection with this college, we have used in our preparatory department the Series of Readers known as the "National Readers," compiled by Parker & Watson, and published by Messrs. A. S. Barnes & Co. They are *excellent*; afford choice selections; contain the right system of elocutionary instruction, and are well printed and bound so as to be serviceable as well as interesting. I can commend them as among the excellent means used by teachers to make their pupils proficient in that noblest of school arts, GOOD READING.

From W. T. HARRIS, Supt. Public Schools, St. Louis, Mo.

I have to admire these excellent selections in prose and verse, and the careful arrangement which places first what is easy of comprehension, and proceeds gradually to what is difficult. I find the lessons so arranged as to bring together different treatments of the same topic, thereby throwing much light on the pupil's path, and I doubt not adding greatly to his progress. The proper variety of subjects chosen, the concise treatise on elocution, the beautiful typography and substantial binding—all these I find still more admirable than in the former series of National Readers, which I considered *models* in these respects.

From H. T. PHILLIPS, Esq., of the Board of Education, Atlanta, Ga.

The Board of Education of this city have selected for use in the public schools of Atlanta the entire series of your Independent Readers, together with Steele's (Chemistry and Philosophy. As a member of the Board, and of the Committee on Text-books, the subject of Readers was referred to me for examination. I gave a pretty thorough examination to ten (10) different series of Readers, and in endeavoring to arrive at a decision upon the sole question of merit, and entirely independent of any extraneous influence, I very cordially recommended the Independent Series. This verdict was approved by the Committee and adopted by the Board.

From Report of REV. W. T. BRANTLY, D.D., late Professor of Belles Lettres, University of Georgia, on "Text-Books in Reading," before the Teachers' Convention of Georgia, May 4, 1870.

The *National Series*, by Parker & Watson, is deserving of its high reputation. The Primary Books are suited to the weakest capacity; whilst those more advanced supply instructive illustration on all that is needed to be known in connection with the art.

WATSON'S CHILD'S SPELLER.

THE INDEPENDENT CHILD'S SPELLER.

Price 25 Cents.

This unique book, published in 1872, is the first to be consistently printed in imitation of writing; that is, it teaches orthography as we use it. It is for the smallest class of learners, who soon become familiarized with words by their forms, and learn to read writing while they spell.

EXTRACT FROM THE PREFACE.

Success in teaching English orthography is still exceptional, and it must so continue until the principles involved are recognized in practice. Form is foremost: the eye and the hand must be trained to the formation of words; and since spelling is a part of writing, the written form only should be used. The laws of mental association, also—especially those of resemblance, contrast, and contiguity in time and place—should receive such recognition in the construction of the text-book as shall insure, whether consciously or not, their appropriate use and legitimate results. Hence, the spelling-book, properly arranged, is a necessity from the first; and, though primers, readers, and dictionaries may serve as aids, it can have no competent substitute.

Consistently with these views, the words used in the Independent Child's Speller have such original classifications and arrangements in columns—in reference to location, number of letters, vowel sounds, alphabetic equivalents, and consonant terminations—as exhibit most effectively their formation and pronunciation. The vocabulary is strictly confined to the simple and significant monosyllables in common use. He who has mastered these may easily learn how to spell and pronounce words of more than one syllable.

The introduction is an illustrated alphabet in script, containing twenty-six pictures of objects, and their names, commencing both with capitals and small letters. Part First embraces the words of one, two, and three letters; Part Second, the words of four letters; and Part Third, other monosyllables. They are divided into short lists and arranged in columns, the vowels usually in line, so as to exhibit individual characteristics and similarity of formation. The division of words into paragraphs is shown by figures in the columns. Each list is immediately followed by sentences for reading and writing, in which the same words are again presented with irregularities of form and sound. Association is thus employed, memory tested, and definition most satisfactorily taught.

Among the novel and valuable features of the lessons and exercises, probably the most prominent are their adaptedness for young children and their being printed in exact imitation of writing. The author believes that hands large enough to spin a top, drive a hoop, or catch a ball, are not too small to use a crayon, or a slate and pencil; that the child's natural desire to draw and write should not be thwarted, but gratified, encouraged, and wisely directed; and that since the written form is the one actually used in connection with spelling in after-life, the eye and the hand of the child should be trained to that form from the first. He hopes that this little work, designed to precede all other spelling-books and conflict with none, may satisfy the need so universally recognized of a fit introduction to orthography, penmanship, and English composition.

The National Readers and Spellers.

THEIR RECORD.

These books have been adopted by the School Boards, or official authority, of the following important States, cities, and towns—in most cases for exclusive use

The State of Minnesota.

The State of Texas.

The State of Missouri.

The State of Alabama.

The State of North Carolina.

The State of Louisiana.

New York.

New York City.
Brooklyn.
Buffalo.
Albany.
Rochester.
Troy.
Syracuse.
Elmira.
&c., &c.

Illinois.

Chicago.
Peoria.
Alton.
Springfield.
Aurora.
Galesburg.
Rockford.
Rock Island.
&c., &c.

Indiana.

New Albany.
Fort Wayne.
Lafayette.
Madison.
Logansport.
Indianapolis.

Pennsylvania.

Reading.
Lancaster.
Erie.
Scranton.
Carlisle.
Carbondale.
Westchester.
Schuylkill Haven.
Williamsport.
Norristown.
Bellefonte.
Wilkesbarre.
&c., &c.

Wisconsin.

Milwaukee.
Fond du Lac.
Oshkosh.
Janesville.
Racine.
Watertown.
Sheboygan.
La Crosse.
Waukesha.
Kenosha.
&c., &c.

Iowa.

Davenport.
Burlington.
Muscatine.
Mount Pleasant.
&c.

Nebraska.

Brownsville.
Lincoln.
&c.

Oregon.

Portland.
Salem.
&c.

New Jersey.

Newark.
Jersey City.
Paterson.
Trenton.
Camden.
Elizabeth.
New Brunswick.
Phillipsburg.
Orange.
&c., &c.

Michigan.

Grand Rapids.
Kalamazoo.
Adrian.
Jackson.
Molroe.
Lansing.
&c., &c.

Virginia.

Richmond.
Norfolk.
Petersburg.
Lynchburg.
&c.

South Carolina.

Columbia.
Charleston.

Ohio.

Toledo.
Sandusky.
Conneaut.
Chardon.
Hudson.
Canton.
Salem.
&c., &c.

Georgia.

Savannah.

Louisiana.

New Orleans.

Tennessee.

Memphis

Delaware.

Wilmington.

D. C.

Washington.

The *Educational Bulletin* records periodically all new points gained.

SCHOOL-ROOM CARDS.

Baade's Reading Case, *\$10 00

A frame containing movable cards, with arrangement for showing one sentence at a time, capable of 28,000 transpositions.

Eureka Alphabet Tablet *\$1 50

Presents the alphabet upon the Word Method System, by which the child will learn the alphabet in nine days, and make no small progress in reading and spelling in the same time.

National School Tablets, 10 Nos. *\$8 00

Embrace reading and conversational exercises, object and moral lessons, form, color, &c. A complete set of these large and elegantly illustrated Cards will embellish the school-room more than any other article of furniture.

READING.

Fowle's Bible Reader. \$1 00

The narrative portions of the Bible, chronologically and topically arranged, judiciously combined with selections from the Psalms, Proverbs, and other portions which inculcate important moral lessons or the great truths of Christianity. The embarrassment and difficulty of reading the Bible itself, by course, as a class exercise, are obviated, and its use made feasible, by this means.

North Carolina First Reader 40

North Carolina Second Reader 65

North Carolina Third Reader 1 00

Prepared expressly for the schools of this State, by C. H. Wiley, Superintendent of Common Schools, and F. M. Hubbard, Professor of Literature in the State University.

Parker's Rhetorical Reader. 1 00

Designed to familiarize Readers with the pauses and other marks in general use, and lead them to the practice of modulation and inflection of the voice.

Introductory Lessons in Reading and Elocution 75

Of similar character to the foregoing, for less advanced classes.

High School Literature. 1 50

Admirable selections from a long list of the world's best writers, for exercise in reading, oratory, and composition. Speeches, dialogues, and model letters represent the latter department.

ORTHOGRAPHY.

SMITH'S SERIES

Supplies a speller for every class in graded schools, and comprises the most complete and excellent treatise on English Orthography and its companion branches extant.

1. **Smith's Little Speller** \$ 20
First Round in the Ladder of Learning.

2. **Smith's Juvenile Definer** 45
Lessons composed of familiar words grouped with reference to similar signification or use, and correctly spelled, accented, and defined.

3. **Smith's Grammar-School Speller** 50
Familiar words, grouped with reference to the sameness of sound of syllables differently spelled. Also definitions, complete rules for spelling and formation of derivatives, and exercises in false orthography.

4. **Smith's Speller and Definer's Manual** 90
A complete *School Dictionary* containing 14,000 words, with various other useful matter in the way of Rules and Exercises.

5. **Smith's Etymology**—Small, 75; Complete . 1 25
The first and only Etymology to recognize the *Anglo-Saxon* our *mother tongue*; containing also full lists of derivatives from the Latin, Greek, Gaelic, Swedish, Norman, &c., &c : being, in fact, a complete etymology of the language for schools.

Sherwood's Writing Speller 15

Sherwood's Speller and Definer 15

Sherwood's Speller and Pronouncer 15

The Writing Speller consists of properly ruled and numbered blanks to receive the words dictated by the teacher, with space for remarks and corrections. The other volumes may be used for the dictation or ordinary class exercises.

Price's English Speller *15

A complete spelling-book for all grades, containing more matter than "Webster," manufactured in superior style, and sold at a lower price—consequently the cheapest speller extant.

Northend's Dictation Exercises 63

Embracing valuable information on a thousand topics, communicated in such a manner as at once to relieve the exercise of spelling of its usual tedium, and combine it with instruction of a general character calculated to profit and amuse.

Wright's Analytical Orthography 25

This standard work is popular, because it teaches the elementary sounds in a plain and philosophical manner, and presents orthography and orthoepy in an easy, uniform system of analysis or parsing.

Fowle's False Orthography 43
Exercises for correction.

Page's Normal Chart *3 75
The elementary sounds of the language for the school-room walls.

ORTHOGRAPHY—Continued.

Barber's Critical Writing Speller 20 cts.

"The Student's Own Hand-Book of Orthography, Definitions, and Sentences, consisting of Written Exercises in the Proper Spelling, Meaning, and Use of Words." (Published 1873.) This differs from Sherwood's and other Writing Spellers in its more comprehensive character. Its blanks are adapted to writing whole sentences instead of detached words, with the proper divisions for numbering, corrections, etc. Such aids as this, like Watson's Child's Speller and Sherwood's Writing Speller, find their *raison d'être* in the postulate that the art of correct spelling is dependent upon written, and not upon spoken language, for its utility, if not for its very existence. Hence the indirectness of purely oral instruction.

ETYMOLOGY.

Smith's Complete Etymology, \$1 25

Smith's Condensed Etymology, 75

Containing the Anglo-Saxon, French, Dutch, German, Welsh, Danish, Gothic, Swedish, Gaelic, Italian, Latin, and Greek Roots, and the English words derived therefrom accurately spelled, accented, and defined.

From HON. JNO. G. McMYNN, late State Superintendent of Wisconsin.

I wish every teacher in the country had a copy of this work.

From PRIN. WM. F. PHELPS, Minn. State Normal.

The book is superb—just what is needed in the department of etymology and spelling.

From PROF. C. H. VERRILL, Pa. State Normal School.

The Etymology (Smith's) which we procured of you we like much. It is the best work for the class-room we have seen.

From HON. EDWARD BALLARD, Supt. of Common Schools, State of Maine.

Many a teacher who has turned his attention to the derivation of words has rejoiced in the helps furnished by dictionaries and smaller "hand-books," where his taste could be gratified, and the labors of patient students have been available to his own improvement. A treatise on this subject, called "A Complete Etymology of the English Language," contains very much information in a small space. The author, W. W. Smith, is evidently a lover of this branch of study, and has furnished a manual of singular utility for its purpose.

DICTIONARY.

The Topical Lexicon, 1 75

This work is a School Dictionary, an Etymology, a compilation of synonyms, and a manual of general information. It differs from the ordinary lexicon in being arranged by topics instead of the letters of the alphabet, thus realizing the apparent paradox of a "Readable Dictionary." An unusually valuable school-book.

ENGLISH GRAMMAR.

CLARK'S DIAGRAM SYSTEM.

Clark's Beginner's Grammar, \$0 60

(Published 1872.) The Beginner's Grammar contains illustrated object-lessons of the most attractive character, and is couched in language freed as much as possible from the dry technicalities of the science. Part I is adapted to youngest scholars, and the whole forms a complete "brief course" in one volume.

This work is designed to take the place of the same author's well-known "First Lessons," with all the improvements which sixteen years of additional experience and the criticisms of our best teachers have suggested. It is fuller, while more simple, than its predecessor, more space being given to examples and exercises. The whole subject is also more broadly treated.

Clark's Normal Grammar, 1 00

Published 1870, and designed to take the place of Prof. Clark's veteran "Practical" Grammar, though the latter is still furnished upon order. The Normal is an entirely new treatise. It is a full exposition of the system as described below, with all the most recent improvements. Some of its peculiarities are—A happy blending of SYNTHESES with ANALYSES; thorough Criticisms of common errors in the use of our Language; and important improvements in the Syntax of Sentences and of Phrases.

Clark's Key to the Diagrams, 1 00

Clark's Analysis of the English Language, 60

Clark's Grammatical Chart, *3 75

The theory and practice of teaching grammar in American schools is meeting with a thorough revolution from the use of this system. While the old methods offer proficiency to the pupil only after much weary plodding and dull memorizing, this affords from the inception the advantage of *practical Object Teaching*, addressing the eye by means of illustrative figures; furnishes association to the memory, its most powerful aid, and diverts the pupil by taxing his ingenuity. Teachers who are using Clark's Grammar uniformly testify that they and their pupils find it the most interesting study of the school course.

Like all great and radical improvements, the system naturally met at first with much unreasonable opposition. It has not only outlived the greater part of this opposition, but finds many of its warmest admirers among those who could not at first tolerate so radical an innovation. All it wants is an impartial trial to convince the most skeptical of its merit. No one who has fairly and intelligently tested it in the school-room has ever been known to go back to the old method. A great success is already established, and it is easy to prophesy that the day is not far distant when it will be the *only system of teaching English Grammar*. As the SYSTEM is copyrighted, no other text-books can appropriate this obvious and great improvement.

Welch's Analysis of the English Sentence; 1 25

Remarkable for its new and simple classification, its method of treating connectives, its explanations of the idioms and constructive laws of the language, etc.

Clark's Diagram English Grammar.

TESTIMONIALS.

From J. A. T. DUERNIN, Principal Dubuque R. C. Academy, Iowa.

In my opinion, it is well calculated by its system of analysis to develop those rational faculties which in the old systems were rather left to develop themselves, while the memory was overtaxed, and the pupils discouraged.

From B. A. COX, School Commissioner, Warren County, Illinois.

I have examined 150 teachers in the last year, and those having studied or taught Clark's System have universally stood fifty per cent better examinations than those having studied other authors.

From M. H. B. BUKKET, Principal Masonic Institute, Georgetown, Tennessee.

I traveled two years amusing myself in instructing (exclusively) Grammar classes with Clark's system. The first class I instructed fifty days, but found that this was more time than was required to impart a theoretical knowledge of the science. During the two years thereafter I instructed classes only thirty days each. Invariably I proposed that unless I prepared my classes for a more thorough, minute, and accurate knowledge of English Grammar than that obtained from the ordinary books and in the ordinary way in from one to two years, I would make no charge. I never failed in a solitary case to far exceed the hopes of my classes, and made money and character rapidly as an instructor.

From A. B. DOUGLASS, School Commissioner, Delaware County, New York.

I have never known a class pursue the study of it under a live teacher, that has not succeeded; I have never known it to have an opponent in an educated teacher who had thoroughly investigated it; I have never known an ignorant teacher to examine it; I have never known a teacher who has used it, to try any other.

From J. A. DODGE, Teacher and Lecturer on English Grammar, Kentucky.

We are tempted to assert that it foretells the dawn of a brighter age to our mother-tongue. Both pupil and teacher can fare sumptuously upon its contents, however highly they may have prized the manuals into which they may have been initiated, and by which their expressions have been moulded.

From W. T. CHAPMAN, Superintendent Public Schools, Wellington, Ohio.

I regard Clark's System of Grammar the best published. For teaching, the analysis of the English Language, it surpasses any I ever used.

From F. S. LYON, Principal South Norwalk Union School, Connecticut.

During ten years' experience in teaching, I have used six different authors on the subject of English Grammar. I am fully convinced that Clark's Grammar is better calculated to make thorough grammarians than any other that I have seen.

From CATALOGUE OF ROBBEE'S COMMERCIAL COLLEGE, St. Louis, Missouri.

We do not hesitate to assert, without fear of successful contradiction, that a better knowledge of the English language can be obtained by this system in six weeks than by the old methods in as many months.

From A. PICKETT, President of the State Teachers' Association, Wisconsin.

A thorough experiment in the use of many approved authors upon the subject of English Grammar has convinced me of the superiority of Clark. When the pupil has completed the course, he is left upon a foundation of principle, and not upon the dictum of the author.

From GEO. F. McFAELAND, Prin. McAllisterville Academy, Juniata Co., Penn.

At the first examination of public-school teachers by the county superintendent, when one of our student teachers commenced analyzing a sentence according to Clark, the superintendent listened in mute astonishment until he had finished, then asked what that meant, and finally, with a very knowing look, said such work wouldn't do here, and asked the applicant to parse the sentence right, and gave the lowest certificates to all who barely mentioned Clark. Afterwards, I presented him with a copy, and the next fall he permitted it to be partially used, while the third or last fall, he openly commended the system, and appointed three of my best teachers to explain it at the two Institutes and one County Convention held since September.

For further testimony of equal force, see the Publishers' Special Circular, or current numbers of the Educational Bulletin.

G E O G R A P H Y .

NATIONAL GEOGRAPHICAL SYSTEM.

THE SERIES.

I. Monteilth's First Lessons in Geography, . . .	\$ 65
II. Monteilth's New Manual of Geography, . . .	1 10
III. McNally's System of Geography, . . .	2 00

INTERMEDIATE OR ALTERNATE VOLUMES.

1*. Monteilth's Introduction to Geography, . . .	68
2*. Monteilth's Physical and Political Geography, . . .	1 88

ACCESSORIES.

Monteilth's Wall Maps (per set) . . .	*20 00
Monteilth's Manual of Map-Drawing (Allen's System) . .	25
Monteilth's Map-Drawing and Object-Lessons, . . .	75
Monteilth's Map-Drawing Scale, . . .	*25

1. **PRACTICAL OBJECT TEACHING.** The infant scholar is first introduced to a *picture* whence he may derive notions of the shape of the earth, the phenomena of day and night, the distribution of land and water, and the great natural divisions, which mere words would fail entirely to convey to the untutored mind. Other pictures follow on the same plan, and the child's mind is called upon to grasp no idea without the aid of a pictorial illustration. Carried on to the higher books, this system culminates in Physical Geography, where such matters as climates, ocean currents, the winds, peculiarities of the earth's crust, clouds and rain, are pictorially explained and rendered apparent to the most obtuse. The illustrations used for this purpose belong to the highest grade of art.

2. **CLEAR, BEAUTIFUL, AND CORRECT MAPS.** In the lower numbers the maps avoid unnecessary detail, while respectively progressive, and affording the pupil new matter for acquisition each time he approaches in the constantly enlarging circle the point of coincidence with previous lessons in the more elementary books. In the Physical and Political Geography the maps embrace many new and striking features. One of the most effective of these is the new plan for displaying on each map the relative sizes of countries not represented, thus obviating much confusion which has arisen from the necessity of presenting maps in the same atlas drawn on different scales. The maps of "McNally" have long been celebrated for their superior beauty and completeness. This is the only school-book in which the attempt to make a *complete atlas also clear and distinct*, has been successful. The map *coloring* throughout the series is also noticeable. Delicate and subdued tints take the place of the startling glare of inharmonious colors which too frequently in such treatises dazzle the eyes, distract the attention, and serve to overwhelm the names of towns and the natural features of the landscape.

GEOGRAPHY—Continued.

3. **THE VARIETY OF MAP EXERCISE.** Starting each time from a different basis, the pupil in many instances approaches the same fact no less than *six times*, thus indelibly impressing it upon his memory. At the same time this system is not allowed to become wearisome—the extent of exercise on each subject being graduated by its relative importance or difficulty of acquisition.

4. **THE CHARACTER AND ARRANGEMENT OF THE DESCRIPTIVE TEXT.** The cream of the science has been carefully culled, unimportant matter rejected, elaboration avoided, and a brief and concise manner of presentation cultivated. The orderly consideration of topics has contributed greatly to simplicity. Due attention is paid to the facts in history and astronomy which are inseparably connected with, and important to the proper understanding of geography—and *such only* are admitted on any terms. In a word, the National System teaches geography as a science, pure, simple, and exhaustive.

5. **ALWAYS UP TO THE TIMES.** The authors of these books, editorially speaking, never sleep. No change occurs in the boundaries of countries, or of counties, no new discovery is made, or railroad built, that is not at once noted and recorded, and the next edition of each volume carries to every school-room the new order of things.

6. **SUPERIOR GRADATION.** This is the only series which furnishes an available volume for every possible class in graded schools. It is not contemplated that a pupil must necessarily go through every volume in succession to attain proficiency. On the contrary, *two* will suffice, but *three* are advised; and if the course will admit, the whole series should be pursued. At all events, the books are at hand for selection, and every teacher, of every grade, can find among them one *exactly suited* to his class. The best combination for those who wish to abridge the course consists of Nos. 1, 2, and 3, or where children are somewhat advanced in other studies when they commence geography, Nos. 1*, 2, and 3. Where but *two* books are admissible, Nos. 1* and 2*, or Nos. 2 and 3, are recommended.

7. **FORM OF THE VOLUMES AND MECHANICAL EXECUTION.** The maps and text are no longer unnaturally divorced in accordance with the time-honored practice of making text-books on this subject as inconvenient and expensive as possible. On the contrary, all map questions are to be found on the page opposite the map itself, and each book is complete in one volume. The mechanical execution is unrivalled. Paper and printing are everything that could be desired, and the binding is—A. S. Barnes and Company's.

8. **MAP-DRAWING.** In 1869 the system of Map-Drawing devised by Professor JEROME ALLEN was secured *exclusively* for this series. It derives its claim to originality and usefulness from the introduction of a *fixed unit of measurement* applicable to every Map. The principles being so few, simple and comprehensive, the subject of Map-Drawing is relieved of all practical difficulty. (In Nos. 2, 2*, and 3, and published separately.)

8. **ANALOGOUS OUTLINES.** At the same time with Map-Drawing was also introduced (in No. 2), a new and ingenious variety of Object Lessons, consisting of a comparison of the outlines of countries with familiar objects pictorially represented.

GEOGRAPHY—Continued.

MONTEITH'S COMPREHENSIVE GEOGRAPHY.

Price \$1.60.

This book (published 1872) is the fruit and condensation of all the author's experience. It is not an old book revamped—not an addition to any series, but a *book by itself*; complete, independent, comprehensive, yet simple, brief, cheap, an popular. A "series" in one volume, adequate to the entire common-school course. It presents the following features, skillfully interwoven—the student learning all about one country at a time.

LOCAL GEOGRAPHY, or the Use of Maps, of which the work contains ninety-eight distinct ones. Important features of the Maps are the coloring of States as objects, and the care taken not to overcrowd them with names of secondary importance.

PHYSICAL GEOGRAPHY, or the Natural Features of the Earth, illustrated by the original and striking *Relief Maps*, being bird's-eye views or photographic pictures of the Earth's surface.

DESCRIPTIVE GEOGRAPHY, including the Physical; with some account of Governments, and Races, Animals, etc.

HISTORICAL GEOGRAPHY, or a brief summary of the salient points of history, explaining the present distribution of nations, origin of geographical names, etc.

MATHEMATICAL GEOGRAPHY, including ASTRONOMICAL, which describes the Earth's position and character among planets; also the Zones, Parallels, etc.

COMPARATIVE GEOGRAPHY, or a system of analogy, connecting new lessons with the previous ones. Comparative sizes and latitudes are shown on the margin of each Map, and all countries are measured in the "*frame of Kansas*."

TOPICAL GEOGRAPHY, consisting of questions for review, and testing the student's general and specific knowledge of the subject, with suggestions for *Geographical Compositions*.

ANCIENT GEOGRAPHY. A section devoted to this subject, with Maps, will be appreciated by teachers. It is seldom taught in our common schools, because it has heretofore required the purchase of a separate book.

GRAPHIC GEOGRAPHY, or MAP-DRAWING by Allen's "Unit of Measurement" system (now almost universally recognized as without a rival) is introduced throughout the lessons, and not as an appendix.

CONSTRUCTIVE GEOGRAPHY, or GLOBE-MAKING. With each book a set of Map Segments is furnished, with which each student may make his own Globe by following the directions given.

RAILROAD GEOGRAPHY, with a grand Map illustrating routes of travel in the United States.

The National System of Geography,

BY MONTEITH & McNALLY.

ITS RECORD.

These popular text-books have been adopted, by official authority, for the schools of the following States, cities, and associations—in most cases for exclusive and uniform use.

CALIFORNIA.
MISSOURI.
ALABAMA.
TENNESSEE.
TEXAS.

STATES.
VERMONT.
IOWA.
LOUISIANA.

FLORIDA.
MINNESOTA.
NORTH CAROLINA.
KANSAS.
MISSISSIPPI.

CITIES.

New York City.
Brooklyn.
New Orleans.
Buffalo.
Richmond.
Jersey City.
Hartford.
Worcester.

Louisville.
Newark.
Milwaukee.
Charleston.
Rochester.
Mobile.
Syracuse.
Memphis.

Nashville.
Utica.
Wilmington.
Trenton.
Norfolk.
Norwich.
Lockport.
Dubuque.

Portland.
Savannah.
Indianapolis.
Springfield.
Wheeling.
Toledo.
Bridgeport.
St. Paul.

ASSOCIATIONS.

The Society of the CHRISTIAN BROTHERS, representing 40,000 pupils.

The FRANCISCAN BROTHERS, 8,000 pupils.

AMERICAN MISSIONARY SOCIETY, 50,000 pupils.

Monteith's Physical and Political Geography.

This is the most recently published of the Geographical Series, and as might have been anticipated, was very warmly received.

TESTIMONIALS IN BRIEF.

The more I examine the better I am pleased.—J. T. GOODNOW, *late Sc. Supt. Kan.*
Has no superior as a text-book.—E. J. THOMPSON, *Supt. Fillmore Co., Minn.*
Brief, clear, suggestive, and admirably adapted.—E. CONANT, *Prin. Vt. Normal.*
It is a gem of a book.—E. A. STRONG, *Supt. Public Schools, Grand Rapids, Mich.*
The best adapted we have seen.—O. FAVILLE, *late State Supt., Iowa.*
A book that has long been needed.—A. J. KINGMAN, *Supt. McHenry Co., Ill.*
Prepared with labor, care, and well adapted.—C. B. HALSTEAD, *Supt. Newburg, N. Y.*
The best Geography ever published.—J. HUTCHISON, *Prin. Boys' Sch. Jefferson, La.*
I like it very much.—A. J. CRAIG, *late State Supt., Wisconsin.*
Cannot fail to awaken a new interest.—*Vermont School Journal.* [Coll., Va.
A new field cultivated with great success.—T. C. JOHNSON, *Pres. Randolph Macon.*
Contains more common sense than any other.—J. ANGEAR, *Prin. Madison Ac. Iowa.*

Monteith & McNally's National Geographies.

CRITICAL OPINIONS.

From R. A. ADAMS, Member of Board of Education, New York.

I have found, by examination of the Book of Supply of our Board, that considerably the largest number of any series now used in our public schools is the National, by Monteith and McNally.

From BRO. PATRICK, Chief Provincial of the Vast Educational Society of the CHRISTIAN BROTHERS in the United States.

Having been convinced for some time past that the series of Geographies in use in our schools were not giving satisfaction, and came far short of meeting our most reasonable expectations, I have felt it my imperative duty to examine into this matter, and see if a remedy could not be found.

Copies of the different Geographies published in this country have been placed at our command for examination. On account of other pressing duties we have not been able to give as much time to the investigation of all these different series as we could have desired; yet we have found enough to convince us that there are many others better than those we are now using; but we cheerfully give our most decided preference, above all others, to the National Series, by Monteith & McNally.

Their easy gradation, their thoroughly practical and independent character, their comprehensive completeness as a full and accurate system, the wise discrimination shown in the selection of the subject matter, the beautiful and copious illustrations, the neat cut type, the general execution of the works, and other excellencies, will commend them to the friends of education everywhere.

From the "HOME MONTHLY," Nashville, Tenn.

MONTETH'S AND McNALLY'S GEOGRAPHIES.—Geography is so closely connected with Astronomy, History, Ethnology, and Geology, that it is difficult to define its limits in the construction of a text-book. If the author confines himself strictly to a description of the earth's surface, his book will be dry, meager, and unintelligible to a child. If, on the other hand, he attempts to give information on the cognate sciences, he enters a boundless field, and may wander too far. It seems to us that the authors of the series before us have hit on the happy medium between too much and too little. *The First Lessons*, by applying the system of object-teaching, renders the subject so attractive that a child, just able to read, may become deeply interested in it. The second book of the course enlarges the view, but still keeps to the maps and simple descriptions. Then, in the third book, we have Geography combined with History and Astronomy. A general view of the solar system is presented, so that the pupil may understand the earth's position on the map of the heavens. The first part of the fourth book treats of Physical Geography, and contains a vast amount of knowledge compressed into a small space. It is made bright and attractive by beautiful pictures and suggestive illustrations, on the principle of object-teaching. The maps in the second part of this volume are remarkably clear, and the map exercises are copious and judicious. In the fifth and last volume of the series, the whole subject is reviewed and systematized. This is strictly a Geography. Its maps are beautifully engraved and clearly printed. The map exercises are full and comprehensive. In all these books the maps, questions and descriptions are given in the same volume. In most geographies there are too many details and minute descriptions—more than any child out of purgatory ought to be required to learn. The power of memory is overstrained; there is confusion—no clearly defined idea is formed in the child's mind. But in these books, in brief, pointed descriptions, and constant use of bright, accurate maps, the whole subject is photographed on the mind.

MATHEMATICS.

DAVIES' NATIONAL COURSE.

ARITHMETIC.

		SLATED.
1. Davies' Primary Arithmetic,	\$ 25	\$ 32
2. Davies' Intellectual Arithmetic,	40	48
3. Davies' Elements of Written Arithmetic,	50	60
4. Davies' Practical Arithmetic,	90	1 00
Key to Practical Arithmetic,	90	
5. Davies' University Arithmetic,	1 40	1 50
Key to University Arithmetic,	*1 40	

ALGEBRA.

1. Davies' New Elementary Algebra,	*1 25	1 35
Key to Elementary Algebra,	*1 25	
2. Davies' University Algebra,	1 50	1 60
Key to University Algebra,	*1 50	
3. Davies' New Bourdon's Algebra,	2 25	2 38
Key to Bourdon's Algebra,	*2 25	

GEOMETRY.

1. Davies' Elementary Geometry and Trigonometry,	1 40	1 50
2. Davies' Legendre's Geometry,	2 25	2 38
3. Davies' Analytical Geometry and Calculus,	2 50	2 63
4. Davies' Descriptive Geometry,	2 75	2 88
5. Davies' New Calculus,	2 00	

MENSURATION.

1. Davies' Practical Mathematics and Mensuration,	1 50	1 60
2. Davies' Elements of Surveying,	2 50	2 63
3. Davies' Shades, Shadows, and Perspective,	3 75	3 88

MATHEMATICAL SCIENCE.

Davies' Grammar of Arithmetic,	* 50
Davies' Outlines of Mathematical Science,	*1 00
Davies' Nature and Utility of Mathematics, 8vo, *2 00, 12mo,	*1 50
Davies' Metric System,	*1 50
Davies & Peck's Dictionary of Mathematics,	*5 00
Davies' Foundations Mathematical Science,	* 25

DAVIES' NATIONAL COURSE of MATHEMATICS. ITS RECORD.

In claiming for this series the first place among American text-books, of what ever class, the Publishers appeal to the magnificent record which its volumes have earned during the *thirty-five years* of Dr. Charles Davies' mathematical labors. The unremitting exertions of a life-time have placed the *modern series* of the same proud eminence among competitors that each of its predecessors has successively enjoyed in a course of constantly improved editions, now rounded to their perfect fruition—for it seems almost that this science is susceptible of no further demonstration.

During the period alluded to, many authors and editors in this department have started into public notice, and by borrowing ideas and processes original with Dr. Davies, have enjoyed a brief popularity, but are now almost unknown. Many of the series of to-day, built upon a similar basis, and described as "modern books," are destined to a similar fate; while the most far-seeing eye will find it difficult to fix the time, on the basis of any data afforded by their past history, when these books will cease to increase and prosper, and fix a still firmer hold on the affection of every educated American.

One cause of this unparalleled popularity is found in the fact that the enterprise of the author did not cease with the original completion of his books. Always a practical teacher, he has incorporated in his text-books from time to time the advantages of every improvement in methods of teaching, and every advance in science. During all the years in which he has been laboring, he constantly submitted his own theories and those of others to the practical test of the class-room—approving, rejecting, or modifying them as the experience thus obtained might suggest. In this way he has been able to produce an almost perfect series of class-books, in which every department of mathematics has received minute and exhaustive attention.

Nor has he yet retired from the field. Still in the prime of life, and enjoying a ripe experience which no other living mathematician or teacher can emulate, his pen is ever ready to carry on the good work, as the progress of science may demand. Witness his recent exposition of the "Metric System," which received the official endorsement of Congress, by its Committee on Uniform Weights and Measures.

DAVIES' SYSTEM IS THE ACKNOWLEDGED NATIONAL STANDARD FOR THE UNITED STATES, for the following reasons:—

1st. It is the basis of instruction in the great national schools at West Point and Annapolis.

2d. It has received the *quasi* endorsement of the National Congress.

3d. It is exclusively used in the public schools of the National Capital.

4th. The officials of the Government use it as authority in all cases involving mathematical questions.

5th. Our great soldiers and sailors commanding the national armies and navies were educated in this system. So have been a majority of eminent scientists in this country. All these refer to "Davies" as authority.

6th. A larger number of American citizens have received their education from this than from any other series.

7th. The series has a larger circulation throughout the whole country than any other, being *extensively used in every State in the Union.*

Davies' National Course of Mathematics.

TESTIMONIALS.

From L. VAN BOKKELEN, State Superintendent Public Instruction, Maryland.

The series of Arithmetics edited by Prof. Davies, and published by your firm, have been used for many years in the schools of several counties, and the city of Baltimore, and have been approved by teachers and commissioners.

Under the law of 1863, establishing a uniform system of Free Public Schools, these Arithmetics were unanimously adopted by the State Board of Education, after a careful examination, and are now used in all the Public Schools of Maryland.

These facts evidence the high opinion entertained by the School Authorities of the value of the series theoretically and practically.

From HORACE WEBSTER, President of the College of New York.

The undersigned has examined, with care and thought, several volumes of Davies' Mathematics, and is of the opinion that, as a whole, it is the most complete and best course for Academic and Collegiate instruction, with which he is acquainted.

From DAVID N. CAMP, State Superintendent of Common Schools, Connecticut.

I have examined Davies' Series of Arithmetics with some care. The language is clear and precise; each principle is thoroughly analyzed, and the whole so arranged as to facilitate the work of instruction. Having observed the satisfaction and success with which the different books have been used by eminent teachers, it gives me pleasure to commend them to others.

From J. O. WILSON, Chairman Committee on Text-Books, Washington, D. C.

I consider Davies' Arithmetics decidedly superior to any other series, and in this opinion I am sustained, I believe, by the entire Board of Education and Corps of Teachers in this city, where they have been used for several years past.

From JOHN L. CAMPBELL, Professor of Mathematics, Wabash College, Indiana.

A proper combination of abstract reasoning and practical illustration is the chief excellence in Prof. Davies' Mathematical works. I prefer his Arithmetics, Algebras, Geometry and Trigonometry to all others now in use, and cordially recommend them to all who desire the advancement of sound learning.

From MAJOR J. H. WHITTLESLEY, Government Inspector of Military Schools.

Be assured, I regard the works of Prof. Davies, with which I am acquainted, as by far the best text-books in print on the subjects which they treat. I shall certainly encourage their adoption wherever a word from me may be of any avail.

From T. MCC. BALLANTINE, Prof. Mathematics Cumberland College, Kentucky.

I have long taught Prof. Davies' Course of Mathematics, and I continue to like their working.

From JOHN McLEAN BELL, B. A., Prin. of Lower Canada College.

I have used Davies' Arithmetical and Mathematical Series as text-books in the schools under my charge for the last six years. These I have found of great efficacy in exciting, invigorating, and concentrating the intellectual faculties of the young.

Each treatise serves as an introduction to the next higher, by the similarity of its reasonings and methods; and the student is carried forward, by easy and gradual steps, over the whole field of mathematical inquiry, and that, too, in a shorter time than is usually occupied in mastering a single department. I sincerely and heartily recommend them to the attention of my fellow-teachers in Canada.

From D. W. STEELE, Prin. Philokopian Academy, Cold Springs, Texas.

I have used Davies' Arithmetics till I know them nearly by heart. A better series of school-books never were published. I have recommended them until they are now used in all this region of country.

A large mass of similar "Opinions" may be obtained by addressing the publishers for special circular for Davies' Mathematics. New recommendations are published in current numbers of the *Educational Bulletin*.

MATHEMATICS—Continued.

ARITHMETICAL EXAMPLES.

Reuck's Examples in Denominate Numbers \$ 50

Reuck's Examples in Arithmetic 1 00

These volumes differ from the ordinary arithmetic in their peculiarly practical character. They are composed mainly of examples, and afford the most severe and thorough discipline for the mind. While a book which should contain a complete treatise of theory and practice would be too cumbersome for every-day use, the insufficiency of practical examples has been a source of complaint.

HIGHER MATHEMATICS.

Church's Elements of Calculus 2 50

Church's Analytical Geometry 2 50

**Church's Descriptive Geometry, with Shades,
Shadows, and Perspective** 4 00

These volumes constitute the "West Point Course" in their several departments.

Courtenay's Elements of Calculus 3 00

A work especially popular at the South.

Hackley's Trigonometry 2 50

With applications to navigation and surveying, nautical and practical geometry and geodasy.

Peck's Analytical Geometry 1 75

Peck's Practical Calculus 1 75

APPLIED MATHEMATICS.

Peck's Ganot's Popular Physics 1 75

Peck's Elements of Mechanics 2 00

Peck's Practical Calculus 1 75

Prof. W. G. Peck, of Columbia College, has designed the first of these works for the ordinary wants of schools in the department of Natural Philosophy. The work enjoys a high reputation.

The Mechanics and Calculus are the briefest treatises on those subjects now published. Their methods are purely practical, and unembarrassed by the details which rather confuse than simplify science.

SLATED ARITHMETICS.

This consists of the application of an artificially slated surface to the inner cover of a book, with flap of the same opening outward, so that students may refer to the book and use the slate at one and the same time, and as though the slate were detached. When folded up, the slate preserves examples and memoranda till needed. The material used is as durable as the stone slate. The additional cost of books thus improved is trifling.

HISTORY.

Monteith's Youth's History, \$ 75

A History of the United States for beginners. It is arranged upon the catechetical plan, with illustrative maps and engravings, review questions, dates in parentheses (that their study may be optional with the younger class of learners), and interesting Biographical Sketches of all persons who have been prominently identified with the history of our country.

Willard's United States, School edition, 1 40

Do. do. University edition, 2 25

The plan of this standard work is chronologically exhibited in front of the title-page; the Maps and Sketches are found useful assistants to the memory, and dates, usually so difficult to remember, are so systematically arranged as in a great degree to obviate the difficulty. Candor, impartiality, and accuracy, are the distinguishing features of the narrative portion.

Willard's Universal History, 2 25

The most valuable features of the "United States" are reproduced in this. The peculiarities of the work are its great conciseness and the prominence given to the chronological order of events. The margin marks each successive era with great distinctness, so that the pupil retains not only the event but its time, and thus fixes the order of history firmly and usefully in his mind. Mrs. Willard's books are constantly revised, and at all times written up to embrace important historical events of recent date.

Berard's History of England, 1 75

By an authoress well known for the success of her History of the United States. The social life of the English people is felicitously interwoven, as in fact, with the civil and military transactions of the realm.

Ricord's History of Rome, 1 75

Possesses the charm of an attractive romance. The Fables with which this history abounds are introduced in such a way as not to deceive the inexperienced, while adding materially to the value of the work as a reliable index to the character and institutions, as well as the history of the Roman people.

Hanna's Bible History, 1 25

The only compendium of Bible narrative which affords a connected and chronological view of the important events there recorded, divested of all superfluous detail.

Summary of History, Complete 60

American History, \$0 40. French and Eng. Hist. 35

A well proportioned outline of leading events, condensing the substance of the more extensive text-book in common use into a series of statements so brief, that every word may be committed to memory, and yet so comprehensive that it presents an accurate though general view of the whole continuous life of nations.

Marsh's Ecclesiastical History, 2 00

Questions to ditto, 75

Affording the History of the Church in all ages, with accounts of the pagan world during Biblical periods, and the character, rise, and progress of all Religions, as well as the various sects of the worshippers of Christ. The work is entirely non-sectarian, though strictly catholic.

Mill's History of the Jews, 1 75

BARNES' ONE-TERM HISTORY.

A Brief History of the United States, . . . \$1 50

This is probably the MOST ORIGINAL SCHOOL-BOOK published for many years, in any department. A few of its claims are the following:

1. **Brevity.**—The text is complete for Grammar School or intermediate classes, in 290 12mo pages, large type. It may readily be completed, if desired, in one term of study.
2. **Comprehensiveness.**—Though so brief, this book contains the pith of all the wearying contents of the larger manuals, and a great deal more than the memory usually retains from the latter.
3. **Interest** has been a prime consideration. Small books have heretofore been bare, full of dry statistics, unattractive. This one is charmingly written, replete with anecdote, and brilliant with illustration.
4. **Proportion of Events.**—It is remarkable for the discrimination with which the different portions of our history are presented according to their importance. Thus the older works being already large books when the civil war took place, give it less space than that accorded to the Revolution.
5. **Arrangement.**—In six epochs, entitled respectively, Discovery and Settlement, the Colonies, the Revolution, Growth of States, the Civil War, and Current Events.
6. **Catch Words.**—Each paragraph is preceded by its leading thought in prominent type, standing in the student's mind for the whole paragraph.
7. **Key Notes.**—Analogous with this is the idea of grouping battles, etc., about some central event, which relieves the sameness so common in such descriptions, and renders each distinct by some striking peculiarity of its own.
8. **Foot Notes.**—These are crowded with interesting matter that is not strictly a part of history proper. They may be learned or not, at pleasure. They are certain in any event to be read.
9. **Biographies** of all the leading characters are given in full in foot-notes.
10. **Maps.**—Elegant and distinct Maps from engravings on copper-plate, and beautifully colored, precede each epoch, and contain all the places named.
11. **Questions** are at the back of the book, to compel a more independent use of the text. Both text and questions are so worded that the pupil must give intelligent answers in his own words. "Yes" and "No" will not do.
12. **Historical Recreations.**—These are additional questions to test the student's knowledge, in review, as: "What trees are celebrated in our history?" "When did a fog save our army?" "What Presidents died in office?" "When was the Mississippi our western boundary?" "Who said, 'I would rather be right than President?'" etc.
13. **The Illustrations**, about seventy in number, are the work of our best artists and engravers, produced at great expense. They are vivid and interesting, and mostly upon subjects never before illustrated in a school-book.
14. **Dates.**—Only the leading dates are given in the text, and these are so associated as to assist the memory, but at the head of each page is the date of the event first mentioned, and at the close of each epoch a summary of events and dates.
15. **The Philosophy of History** is studiously exhibited—the causes and effects of events being distinctly traced and their interconnection shown.
16. **Impartiality.**—All sectional, partisan, or denominational views are avoided. Facts are stated after a careful comparison of all authorities without the least prejudice or favor.
17. **Index.**—A verbal index at the close of the book perfects it as a work of reference.

It will be observed that the above are all particulars in which School Histories have been signally defective, or altogether wanting. Many other claims to favor it shares in common with its predecessors.

BARNES' BRIEF UNITED STATES HISTORY.

Already prescribed under authority of law for exclusive and uniform use in the public schools of TWO STATES—Texas and Arkansas. Also adopted for HUNDREDS of important CITIES and TOWNS—among which we name Brooklyn, N.Y.; Jersey City, N.J.; Scranton, Pa.; Wilmington, Del.; Portland, Me.; Springfield, Mass.; Louisville, Ky.; Vicksburg, Miss.; Madison, Wis.; Rochester, Minn.; Macon, Mo.; Springfield, Ill., etc.

SOME TESTIMONIALS.

From HON. J. M. MCKENZIE, Supt. Pub. Inst., Nebraska.

I have examined your "Brief History of the United States," and like it *real well*; and were I teaching a graded school, I think I should use it as a text-book.

From HON. H. B. WILSON, Supt. Pub. Inst., Minnesota.

I have read with much interest the "One-Term History of the United States." I am much pleased with it. In my judgment, it contains all of the United States history that the majority of pupils in our common schools can spare time to study.

From PRES. EDWARD BROOKS, Millersville State Normal School, Pa.

It is a work that will be a favorite with teachers and pupils. Its scope and style especially adapt it for use in our public schools. I cordially commend it to teachers desiring to introduce an interesting and practical text-book upon this subject.

From PRES. BARKER, Buffalo State Normal School, N. Y.

In the copy of your "Brief History," before me, the important items to be learned in history seem most ingeniously brought out and kept in the foreground. These items are *time, persons, places, and events*. It has the appearance of an exceedingly fresh and systematic work. I think I shall put it into my classes.

From PROF. WM. F. ALLEN, State Univ. of Wisconsin.

I think the author of the new "Brief History of the United States" has been very successful in combining brevity with sufficient fullness and interest. *Particularly*, he has avoided the excessive number of names and dates that most histories contain. Two features that I like *very much* are the *anecdotes* at the foot of the page and the "*Historical Recreations*" in the Appendix. The latter, I think, is quite a new feature, and the other is *very* well executed.

From S. G. WRIGHT, Assist.-Supt. Pub. Inst., Kansas.

It is with extreme pleasure we submit our recommendation of the "Brief History of the United States." It meets the needs of young and older children, combining concision with perspicuity, and if "brevity is the soul of wit," this "Brief History" contains not only that well-chosen ingredient, but wisdom sufficient to enlighten those students who are wearily longing for a "new departure" from certain old and uninteresting presentations of fossilized writers. We congratulate a progressive public upon a progressive book.

From HON. NEWTON BATEMAN, Supt. Pub. Inst., Illinois.

Barnes' One-Term History of the United States is an exceedingly attractive and spirited little book. Its claim to several new and valuable features seems well founded. Under the form of six well-defined Epochs, the History of the United States is traced tersely, yet pithily, from the earliest times to the present day. A good map precedes each epoch, whereby the history and geography of the period may be studied together, *as they always should be*. The syllabus of each paragraph is made to stand in such bold relief, by the use of large, heavy type, as to be of much *mnemonic* value to the student. The book is written in a sprightly and piquant style, the interest never flagging from beginning to end—a rare and difficult achievement in works of this kind.

From the "Chicago Schoolmaster" (Editorial).

A thorough examination of Barnes' Brief History of the United States brings the examiner to the conclusion that it is a superior book in almost every respect. The book is neat in form, and of good material. The type is clear, large, and distinct. The facts and dates are correct. The arrangement of topics is just the thing needed in a history text-book. By this arrangement the pupil can see at once what he is expected to do. The topics are well selected, embracing the leading ideas or principal events of American history. . . . The book as a whole is much superior to any I have examined. So much do I think this, that I have ordered it for my class, and shall use it in my school. (Signed) B. W. BAKER.

Baker's Brief History of Texas, \$1 25

PENMANSHIP.

Beers' System of Progressive Penmanship.

Per dozen \$1 68

This "round hand" system of Penmanship in twelve numbers, commends itself by its simplicity and thoroughness. The first four numbers are primary books. Nos. 5 to 7, advanced books for boys. Nos. 8 to 10, advanced books for girls. Nos. 11 and 12, ornamental penmanship. These books are printed from steel plates (engraved by McLees), and are unexcelled in mechanical execution. Large quantities are annually sold.

Beers' Slated Copy Slips, per set *50

All beginners should practice, for a few weeks, slate exercises, familiarizing them with the form of the letters, the motions of the hand and arm, &c., &c. These copy slips, 32 in number, supply all the copies found in a complete series of writing-books, at a trifling cost.

Payson, Dunton & Scribner's Copy-B'ks. P. doz., 1 80

The National System of Penmanship, in three distinct series—(1) Common School Series, comprising the first six numbers; (2) Business Series, Nos. 8, 11, and 12; (3) Ladies' Series, Nos. 7, 9, and 10.

Fulton & Eastman's Chirographic Charts, *3 75

To embellish the school room walls, and furnish class exercise in the elements of Penmanship.

Payson's Copy-Book Cover, per hundred . *4 00

Protects every page except the one in use, and furnishes "lines" with proper slope for the penman, under. Patented.

National Steel Pens, Card with all kinds *15

Pronounced by competent judges the perfection of American-made pens, and superior to any foreign article.

SCHOOL SERIES.

School Pen, per gross, . . \$ 60
Academic Pen, do . . . 63
Fine Pointed Pen, per gross 70

POPULAR SERIES.

Capitol Pen, per gross, . . 1 00
do do pr. box of 2 doz. 25
Bullion Pen (imit. gold) pr. gr. 75
Ladies' Pen do 63

Index Pen, per gross . . . 75

BUSINESS SERIES.

Albata Pen, per gross, . . 40
Bank Pen, do . . . 10
Empire Pen, do . . . 70
Commercial Pen, per gross . 60
Express Pen, do . . . 75
Falcon Pen, do . . . 70
Elastic Pen, do . . . 75

Stimpson's Scientific Steel Pen, per gross . *2 00

One forward and two backward arches, ensuring great strength, well-balanced elasticity, evenness of point, and smoothness of execution. One gross in twelve contains a Scientific Gold Pen.

Stimpson's Ink-Retaining Holder, per doz. . *2 00

A simple apparatus, which does not get out of order, withholds at a single dip as much ink as the pen would otherwise realize from a dozen trips to the inkstand, which it supplies with moderate and easy flow.

Stimpson's Gold Pen, \$3 00; with Ink Retainer *4 50

Stimpson's Penman's Card, * 50

One dozen Steel Pens (assorted points) and Patent Ink-retaining Pen holder.

BOOK-KEEPING.

Folsom's Logical Book-keeping,	\$ 2 00
Folsom's Blanks to Book-keeping,	4 50

This treatise embraces the interesting and important discoveries of Prof. Folsom (of the Albany "Bryant & Stratton College"), the partial enunciation of which in lectures and otherwise has attracted so much attention in circles interested in commercial education.

After studying business phenomena for many years, he has arrived at the positive laws and principles that underlie the whole subject of Accounts; finds that the science is based in *Value* as a generic term; that value divides into *two classes* with varied species; that all the exchanges of values are reducible to nine equations; and that all the results of all these exchanges are limited to *thirteen* in number.

As accounts have been universally taught hitherto, without setting out from a radical analysis or definition of values, the science has been kept in great obscurity, and been made as difficult to impart as to acquire. On the new theory, however, these obstacles are chiefly removed. In reading over the first part of it, in which the governing laws and principles are discussed, a person with ordinary intelligence will obtain a fair conception of the *double entry* process of accounts. But when he comes to study thoroughly these laws and principles as there enunciated, and works out the examples and memoranda which elucidate the *thirteen results* of business, the student will neither fail in readily acquiring the science as it is, nor in becoming able intelligently to apply it in the interpretation of business.

Smith & Martin's Book-keeping,	1 25
Smith & Martin's Blanks,	*60

This work is by a practical teacher and a practical book-keeper. It is of a thoroughly popular class, and will be welcomed by every one who loves to see theory and practice combined in an easy, concise, and methodical form.

The Single Entry portion is well adapted to supply a want felt in nearly all other treatises, which seem to be prepared mainly for the use of wholesale merchants, leaving retailers, mechanics, farmers, etc., who transact the greater portion of the business of the country, without a guide. The work is also commended, on this account, for general use in Young Ladies' Seminaries, where a thorough grounding in the simpler form of accounts will be invaluable to the future housekeepers of the nation.

The treatise on Double Entry Book-keeping combines all the advantages of the most recent methods, with the utmost simplicity of application, thus affording the pupil all the advantages of actual experience in the counting-house, and giving a clear comprehension of the entire subject through a judicious course of mercantile transactions.

The shape of the book is such that the transactions can be presented as in actual practice; and the simplified form of Blanks—three in number—adds greatly to the ease experienced in acquiring the science.

D R A W I N G.

Chapman's American Drawing Book, . . . \$6 00

The standard American text-book and authority in all branches of art. A compilation of art principles. A manual for the amateur, and basis of study for the professional artist. Adapted for schools and private instruction.

CONTENTS.—“Any one who can Learn to Write can Learn to Draw.”—Primary Instruction in Drawing.—Rudiments of Drawing the Human Head.—Rudiments in Drawing the Human Figure.—Rudiments of Drawing.—The Elements of Geometry.—Perspective.—Of Studying and Sketching from Nature.—Of Painting.—Etching and Engraving.—Of Modelling.—Of Composition.—Advice to the American Art-Student.

The work is of course magnificently illustrated with all the original designs.

Chapman's Elementary Drawing Book, . . . 1 50

A Progressive Course of Practical Exercises, or a text-book for the training of the eye and hand. It contains the elements from the larger work, and a copy should be in the hands of every pupil; while a copy of the “American Drawing Book,” named above, should be at hand for reference by the class.

The Little Artist's Portfolio, . . . \$50

25 Drawing Cards (progressive patterns), 25 Blanks, and a fine Artist's Pencil, all in one neat envelope.

Clark's Elements of Drawing, . . . \$1 00

A complete course in this graceful art, from the first rudiments of outline to the finished sketches of landscape and scenery.

Fowle's Linear and Perspective Drawing, . . . \$60

For the cultivation of the eye and hand, with copious illustrations and directions for the guidance of the unskilled teacher.

Monk's Drawing Books—Six Numbers, per set, \$2 25

Each book contains *eleven* large patterns, with opposing blanks. No. 1. Elementary Studies. No. 2. Studies of Foliage. No. 3. Landscapes. No. 4. Animals, I. No. 5. Animals, II. No. 6. Marine Views, etc.

Allen's Map-Drawing, . . . 25 cts.; Scale, 25

This method introduces a new era in Map-Drawing, for the following reasons:—

1. It is a system. This is its greatest merit.—2. It is easily understood and taught.—3. The eye is trained to exact measurement by the use of a scale.—4. By no special effort of the memory, distance and comparative size are fixed in the mind.—5. It discards useless construction of lines.—6. It can be taught by any teacher, even though there may have been no previous practice in Map-Drawing.—7. Any pupil old enough to study Geography can learn by this System, in a short time, to draw accurate maps.—8. The System is not the result of theory, but comes directly from the school-room. It has been thoroughly and successfully tested there, with all grades of pupils.—9. It is economical, as it requires no mapping plates. It gives the pupil the ability of rapidly drawing accurate maps.

Ripley's Map-Drawing, . . . 1 25

Based on the Circle. One of the most efficient aids to the acquirement of a knowledge of Geography is the practice of map-drawing. It is useful for the same reason that the best exercise in orthography is the *writing* of difficult words. Sight comes to the aid of hearing, and a double impression is produced upon the memory. Knowledge becomes less mechanical and more intuitive. The student who has sketched the outlines of a country, and dotted the important places, is little likely to forget either. The impression produced may be compared to that of a traveller who has been over the ground, while more comprehensive and accurate in detail.

MUSIC.

Jepson's Music Readers. 3 vols. . . . Each, 75 cts.

These are not books from which children simply learn songs, parrot-like, but teach the subject progressively—the scholar learning to read music by methods similar to those employed in teaching him to read printed language. Any teacher, however ignorant of music, provided he can, upon trial, simply sound the scale, may teach it without assistance, and will end by being a good singer himself. The “Elementary Music Reader,” or first volume, heretofore issued by another publisher, has attained results in the State of Connecticut, where only it has been known, entirely unprecedented in the history of teaching music. The two companion volumes carry the same method into the higher grades.

Nash & Bristow's Cantara. No. 1, \$1.15; No. 2, \$1.40

The first volume is a complete musical text-book for schools of every grade. No. 2 is a choice selection of Solos and Part Songs. The authors are Directors of Music in the public schools of New York City, in which these books are the standard of instruction.

Curtis' Little Singer, \$0 60

Curtis' School Vocalist, 1 00

Kingsley's School-Room Choir, 60

Kingsley's Young Ladies' Harp, 1 00

Hager's Echo, 75

Perkins' Sabbath Carols, 35

For Sunday-schools.

DEVOTION.

Brooks' School Manual of Devotion, . . . \$0 75

This volume contains daily devotional exercises, consisting of a hymn, selections of Scripture for alternate reading by teacher and pupils, and a prayer. Its value for opening and closing school is apparent.

Brooks' School Harmonist, *75

Contains appropriate *tunes* for each hymn in the “Manual of Devotion” described above.

NATURAL SCIENCE.

FAMILIAR SCIENCE.

Norton & Porter's First Book of Science, . \$1 75

By eminent Professors of Yale College. Contains the principles of Natural Philosophy, Astronomy, Chemistry, Physiology, and Geology. Arranged on the Catechetical plan for primary classes and beginners.

Chambers' Treasury of Knowledge, 1 25

Progressive lessons upon—*first*, common things which lie most immediately around us, and first attract the attention of the young mind; *second*, common objects from the Mineral, Animal, and Vegetable kingdoms, manufactured articles, and miscellaneous substances; *third*, a systematic view of Nature under the various sciences. May be used as a Reader or Text-book.

NATURAL PHILOSOPHY.

Norton's First Book in Natural Philosophy, 1 00

By Prof. Norton, of Yale College. Designed for beginners. Profusely illustrated. and arranged on the Catechetical plan.

Peck's Ganot's Course of Nat. Philosophy, . 1 75

The standard text-book of France, Americanized and popularized by Prof. Peck, of Columbia College. The most magnificent system of illustration ever adopted in an American school-book is here found. For intermediate classes.

Peck's Elements of Mechanics, 2 00

A suitable introduction to Bartlett's higher treatises on Mechanical Philosophy, and adequate in itself for a complete academical course.

Bartlett's SYNTHETIC AND ANALYTIC Mechanics, . each 5 00

Bartlett's Acoustics and Optics, 3 50

A system of Collegiate Philosophy, by Prof. BARTLETT, of West Point Military Academy.

Steele's 14 Weeks Course in Philos. (see p. 34) 1 50

Steele's Philosophical Apparatus, *125 00

Adequate to performing the experiments in the ordinary text-books. The articles will be sold separately, if desired. See special circular for details.

GEOLOGY.

Page's Elements of Geology, 1 25

A volume of Chambers' Educational Course. Practical, simple, and eminently calculated to make the study interesting.

Emmons' Manual of Geology, 1 25

The first Geologist of the country has here produced a work worthy of his reputation.

Steele's 14 Weeks Course (see p. 34) 1 50

Steele's Geological Cabinet, *40 00

Containing 125 carefully selected specimens. In four parts. Sold separately, if desired. See circular for details.

Peck's Ganot's Popular Physics.

TESTIMONIALS.

From PROF. ALONZO COLLIN, Cornell College, Iowa.

I am pleased with it. I have decided to introduce it as a text-book.

From H. F. JOHNSON, President Madison College, Sharon, Miss.

I am pleased with Peck's Ganot, and think it a magnificent book.

From PROF. EDWARD BROOKS, Pennsylvania State Normal School.

So eminent are its merits, that it will be introduced as the text-book upon elementary physics in this institution.

From H. H. LOCKWOOD, Professor Natural Philosophy U. S. Naval Academy.

I am so pleased with it that I will probably add it to a course of lectures given to the midshipmen of this school on physics.

From GEO. S. MACKIE, Professor Natural History University of Nashville, Tenn.

I have decided on the introduction of Peck's Ganot's Philosophy, as I am satisfied that it is the best book for the purposes of my pupils that I have seen, combining simplicity of explanation with elegance of illustration.

From W. S. McRAE, Superintendent Vevay Public Schools, Indiana.

Having carefully examined a number of text-books on natural philosophy, I do not hesitate to express my decided opinion in favor of Peck's Ganot. The matter, style, and illustration eminently adapt the work to the popular wants.

From REV. SAMUEL MCKINNEY, D.D., Pres't Austin College, Huntsville, Texas.

It gives me pleasure to commend it to teachers. I have taught some classes with it as our text, and must say, for simplicity of style and clearness of illustration, I have found nothing as yet published of equal value to the teacher and pupil.

From C. V. SPEAR, Principal Maplewood Institute, Pittsfield, Mass.

I am much pleased with its ample illustrations by plates, and its clearness and simplicity of statement. It covers the ground usually gone over by our higher classes, and contains many fresh illustrations from life or daily occurrences, and new applications of scientific principles to such.

From J. A. BANFIELD, Superintendent Marshall Public Schools, Michigan.

I have used Peck's Ganot since 1863, and with increasing pleasure and satisfaction each term. I consider it superior to any other work on physics in its adaptation to our high schools and academies. Its illustrations are superb—better than three times their number of pages of fine print.

From A. SCHUYLER, Prof. of Mathematics in Baldwin University, Berea, Ohio.

After a careful examination of Peck's Ganot's Natural Philosophy, and an actual test of its merits as a text-book, I can heartily recommend it as admirably adapted to meet the wants of the grade of students for which it is intended. Its diagrams and illustrations are *unrivaled*. We use it in the Baldwin University.

From D. C. VAN NORMAN, Principal Van Norman Institute, New York.

The Natural Philosophy of M. Ganot, edited by Prof. Peck, is, in my opinion, the best work of its kind, for the use intended, ever published in this country. Whether regarded in relation to the natural order of the topics, the precision and clearness of its definitions, or the fullness and beauty of its illustrations, it is certainly, I think, an advance.

For many similar testimonials, see current numbers of the *Illustrated Educational Bulletin*.

CHEMISTRY.

Porter's First Book of Chemistry, \$1 00

Porter's Principles of Chemistry, 2 00

The above are widely known as the productions of one of the most eminent scientific men of America. The extreme simplicity in the method of presenting the science, while exhaustively treated, has excited universal commendation.

Darby's Text-Book of Chemistry, 1 75

Purely a Chemistry, divesting the subject of matters comparatively foreign to it (such as heat, light, electricity, etc.), but usually allowed to engross too much attention in ordinary school-books.

Gregory's Organic Chemistry, 2 50

Gregory's Inorganic Chemistry, 2 50

The science exhaustively treated. For colleges and medical students.

Steele's Fourteen Weeks Course, 1 50

A successful effort to reduce the study to the limits of a *single term*, thereby making feasible its general introduction in institutions of every character. The author's felicity of style and success in making the science pre-eminently *interesting* are peculiarly noticeable features. (See page 34.)

Steele's Chemical Apparatus, *20 00

Adequate to the performance of all the important experiments in the ordinary text-book.

Steele's New Chemistry, (see p. 34) 1 50

Contains the new nomenclature.

BOTANY.

Thinker's First Lessons in Botany, 40

For children. The technical terms are largely dispensed with in favor of an easy and familiar style adapted to the smallest learner.

Wood's Object-Lessons in Botany, 1 50

Wood's American Botanist and Florist, 2 50

Wood's New Class-Book of Botany, 3 50

The standard text-books of the United States in this department. In style they are simple, popular, and lively; in arrangement, easy and natural; in description, graphic and strictly exact. The Tables for Analysis are reduced to a perfect system. More are annually sold than of all others combined.

Wood's Plant Record, *75

A simple form of Blanks for recording observations in the field.

Wood's Botanical Apparatus, *8 00

A portable Trunk, containing Drying Press, Knife, Trowel, Microscope, and Tweezers, and a copy of Wood's Plant Record—composing a complete outfit for the collector.

Young's Familiar Lessons, 2 00

Darby's Southern Botany, 2 00

Embracing general Structural and Physiological Botany, with vegetable products, and descriptions of Southern plants, and a complete Flora of the Southern States.

WOOD'S BOTANIES.

TESTIMONIALS.

From PRES. R. B. BURLISON, Waco University, Texas.
Wood's Botanies—books that meet every want in their line.

From PRIN. J. G. RALSTON, Norristown Seminary, Pa.
We find the "Class-Book" entirely satisfactory.

From PRES. D. F. BITTLE, Roanoke College, Va.
Your text-books on Botany are the best for students.

From PROF. W. C. PIERCE, Baldwin University, Ohio.
I think his Flora the best we have. His method of analysis is excellent.

From PROF. BLAKESLEE, State Normal School, Potsdam, N. Y.
It is admirably concise, yet it does not seem to be deficient or obscure. In paper, print, and binding, the book leaves little to be desired.

From PRES. J. M. GREGORY, State Agricultural College, Ill.
I find myself greatly pleased with the perspicuity, compactness, and completeness of the book (Wood's Botanist and Florist). I shall recommend it freely to my friends.

From PROF. A. WINCHELL, University of Michigan.
I am free to say that I had been deeply impressed, I may say almost astonished, at the evidences which the work bears of skillful and experienced authorship in this field, and nice and constant adaptation to the wants and conveniences of students of Botany. I pronounce it emphatically an admirable text-book.

From PROF. RICHARD OWEN, University of Indiana.
I am well pleased with the evidence of philosophical method exhibited in the general arrangement, as well as with the clearness of the explanations, the ready intelligibility of the analytical tables, and the illustrative aid furnished by the numerous and excellent wood-cuts. I design using the work as a text-book with my next class.

From PRIN. B. R. ANDERSON, Columbus Union School, Wisconsin.
I have examined several works with a view to recommending some good text-book on Botany, but I lay them all aside for "Wood's Botanist and Florist." The arrangement of the book is in my opinion excellent, its style fascinating and attractive, its treatment of the various departments of the science is thorough, and last, but far from unimportant, I like the topical form of the questions to each chapter. It seems to embrace the entire science. In fact, I consider it a complete, attractive, and exhaustive work.

From M. A. MARSHALL, New Haven High School, Conn.
It has all the excellencies of the well-known Class-Book of Botany by the same author in a smaller book. By a judicious system of condensation, the size of the Flora is reduced one-half, while no species are omitted, and many new ones are added. The descriptions of species are very brief, yet sufficient to identify the plant, and, when taken in connection with the generic description, form a complete description of the plant. The book as a whole will suit the wants of classes better than anything I have yet seen. The adoption of the Botanist and Florist would not require the exclusion of the Class-Book of Botany, as they are so arranged that both might be used by the same class.

From PROF. G. H. PERKINS, University of Vermont and State Agricultural College.
I can truly say that the more I examine Wood's Class-Book, the better pleased I am with it. In its illustrations, especially of particulars not easily observed by the student, and the clearness and compactness of its statements, as well as in the territory its flora embraces, it appears to me to surpass any other work I know of. The whole science, so far as it can be taught in a college course, is well presented, and rendered unusually easy of comprehension. The mode of analysis is excellent, avoiding as it does to a great extent those microscopic characters which puzzle the beginner, and using those that are obvious as far as possible. I regard the work as a most admirable one, and shall adopt it as a text-book another year.

PHYSIOLOGY.

Jarvis' Elements of Physiology, \$ 75

Jarvis' Physiology and Laws of Health, . 1 65

The only books extant which approach this subject with a proper view of the true object of teaching Physiology in schools, viz., that scholars may know how to take care of their own health. In bold contrast with the abstract *Anatomies*, which children learn as they would Greek or Latin (and forget as soon), to *discipline the mind*, are these text-books, using the *science* as a secondary consideration, and only so far as is necessary for the comprehension of the *laws of health*.

Hamilton's Vegetable & Animal Physiology, 1 25

The two branches of the science combined in one volume lead the student to a proper comprehension of the Analogies of Nature.

Dana's Physiology, Ethics, and Ethnology, 1 25

Steele's Fourteen Weeks in Phy., (see p. 34) 1 50

ASTRONOMY.

Steele's Fourteen Weeks' Course, 1 50

Reduced to a single term, and better adapted to school use than any work heretofore published. Not written for the information of scientific men, but for the inspiration of youth, the pages are not burdened with a multitude of figures which no memory could possibly retain. The whole subject is presented in a clear and concise form. (See p. 34.)

Willard's School Astronomy, 1 00

By means of clear and attractive illustrations, addressing the eye in many cases by analogies, careful definitions of all necessary technical terms, a careful avoidance of verbiage and unimportant matter, particular attention to analysis, and a general adoption of the simplest methods, Mrs. Willard has made the best and most attractive *elementary Astronomy* extant.

McIntyre's Astronomy and the Globes, . . 1 50

A complete treatise for intermediate classes. Highly approved.

Bartlett's Spherical Astronomy, 5 00

The West Point course, for advanced classes, with applications to the current wants of Navigation, Geography, and Chronology.

NATURAL HISTORY.

Carl's Child's Book of Natural History, . . 0 50

Illustrating the Animal, Vegetable, and Mineral Kingdoms, with application to the Arts. For beginners. Beautifully and copiously illustrated.

ZOOLOGY.

Chambers' Elements of Zoology, 1 50

A complete and comprehensive system of Zoology, adapted for academic instruction, presenting a systematic view of the Animal Kingdom as a portion of external Nature.

Jarvis' Physiology and Laws of Health.

TESTIMONIALS.

From SAMUEL B. McLANE, *Superintendent Public Schools, Keokuk, Iowa.*

I am glad to see a really good text-book on this much neglected branch. This is clear, concise, accurate, and eminently adapted to the class-room.

From WILLIAM F. WYERS, *Principal of Academy, West Chester, Pennsylvania.*

A thorough examination has satisfied me of its superior claims as a text-book to the attention of teacher and taught. I shall introduce it at once.

From H. R. SANFORD, *Principal of East Genesee Conference Seminary, N. Y.*

"Jarvis' Physiology" is received, and fully met our expectations. We immediately adopted it.

From ISAAC T. GOODNOW, *State Superintendent of Kansas—published in connection with the "School Law."*

"Jarvis' Physiology," a common-sense, practical work, with just enough of anatomy to understand the physiological portions. The last six pages, on Man's Responsibility for his own health, are worth the price of the book.

From D. W. STEVENS, *Superintendent Public Schools, Fall River, Mass.*

I have examined Jarvis' "Physiology and Laws of Health," which you had the kindness to send to me a short time ago. In my judgment it is far the best work of the kind within my knowledge. It has been adopted as a text-book in our public schools.

From HENRY G. DENNY, *Chairman Book Committee, Boston, Mass.*

The very excellent "Physiology" of D. Jarvis I had introduced into our High School, where the study had been temporarily dropped, believing it to be by far the best work of the kind that had come under my observation; indeed, the reintroduction of the study was delayed for some months, because Dr. Jarvis' book could not be had, and we were unwilling to take any other.

From PROF. A. P. PEABODY, D.D., LL.D., *Harvard University.*

* * I have been in the habit of examining school-books with great care, and I hesitate not to say that, of all the text-books on Physiology which have been given to the public, Dr. Jarvis' deserves the first place on the score of accuracy, thoroughness, method, simplicity of statement, and constant reference to topics of practical interest and utility.

From JAMES N. TOWNSEND, *Superintendent Public Schools, Hudson, N. Y.*

Every human being is appointed to take charge of his own body; and of all books written upon this subject, I know of none which will so well prepare one to do this as "Jarvis' Physiology"—that is, in so small a compass of matter. It considers the pure, simple laws of health paramount to science; and though the work is thoroughly scientific, it is divested of all cumbrous technicalities, and presents the subject of physical life in a manner and style really charming. It is unquestionably the best text-book on physiology I have ever seen. It is giving great satisfaction in the schools of this city, where it has been adopted as the standard.

From L. J. SANFORD, M.D., *Prof. Anatomy and Physiology in Yale College*

Books on human physiology, designed for the use of schools, are more generally a failure perhaps than are school-books on most other subjects.

The great want in this department is met, we think, in the well-written treatise of Dr. Jarvis, entitled "Physiology and Laws of Health." * * The work is not too detailed nor too expansive in any department, and is clear and concise in all. It is not burdened with an excess of anatomical description, nor rendered discursive by many zoological references. Anatomical statements are made to the extent of qualifying the student to attend, understandingly, to an exposition of those functional processes which, collectively, make up health; thus the laws of health are enunciated, and many suggestions are given which, if heeded, will tend to its preservation.

For further testimony of similar character, see current numbers of the Illustrated Educational Bulletin.

NATURAL SCIENCE.

"FOURTEEN WEEKS" IN EACH BRANCH.

By J. DORMAN STEELE, A. M.

Steele's 14 Weeks Course in Chemistry	NEW ED., \$1 50
Steele's 14 Weeks Course in Astronomy	. 1 50
Steele's 14 Weeks Course in Philosophy	. 1 50
Steele's 14 Weeks Course in Geology.	. 1 50
Steele's 14 Weeks Course in Physiology	. 1 50

Our Text-Books in these studies are, as a general thing, dull and uninteresting. They contain from 400 to 600 pages of dry facts and unconnected details. They abound in that which the student cannot learn, much less remember. The pupil commences the study, is confused by the fine print and coarse print, and neither knowing exactly what to learn nor what to hasten over, is crowded through the single term generally assigned to each branch, and frequently comes to the close without a definite and exact idea of a single scientific principle.

Steele's Fourteen Weeks Courses contain only that which every well-informed person should know, while all that which concerns only the professional scientist is omitted. The language is clear, simple, and interesting, and the illustrations bring the subject within the range of home life and daily experience. They give such of the general principles and the prominent facts as a pupil can make familiar as household words within a single term. The type is large and open; there is no fine print to annoy; the cuts are copies of genuine experiments or natural phenomena, and are of fine execution.

In fine, by a system of condensation peculiarly his own, the author reduces each branch to the limits of a single term of study, while sacrificing nothing that is essential, and nothing that is usually retained from the study of the larger manuals in common use. Thus the student has rare opportunity to *economize his time*, or rather to employ that which he has to the best advantage.

A notable feature is the author's charming "style," fortified by an enthusiasm over his subject in which the student will not fail to partake. Believing that Natural Science is full of fascination, he has moulded it into a form that attracts the attention and kindles the enthusiasm of the pupil.

The recent editions contain the author's "Practical Questions" on a plan never before attempted in scientific text-books. These are questions as to the nature and cause of common phenomena, and are not directly answered in the text, the design being to test and promote an intelligent use of the student's knowledge of the foregoing principles.

Steele's General Key to his Works. . . . *1 50

This work is mainly composed of Answers to the Practical Questions and Solutions of the Problems in the author's celebrated "Fourteen Weeks Courses" in the several sciences, with many hints to teachers, minor Tables, &c. Should be on every teacher's desk.

Steele's 14 Weeks in each Science.

TESTIMONIALS.

From L. A. BIKLE, President N. C. College.

I have not been disappointed. Shall take pleasure in introducing this series.

From J. F. COX, Pres. Southern Female College, Ga.

I am much pleased with these books, and expect to introduce them.

From J. R. BRANHAM, Prin. Brownsville Female College, Tenn.

They are capital little books, and are now in use in our institution.

From W. H. GOODALE, Professor Readville Seminary, La.

We are using your 14 Weeks Course, and are much pleased with them.

From W. A. BOLES, Supt. Shelbyville Graded School, Ind.

They are as entertaining as a story book, and much more improving to the mind.

From S. A. SNOW, Principal of High School, Uxbridge, Mass.

Steele's 14 Weeks Courses in the Sciences are a perfect success.

From JOHN W. DOUGHTY, Newburg Free Academy, N. Y.

I was prepared to find Prof. Steele's Course both attractive and instructive. My highest expectations have been fully realized.

From J. S. BLACKWELL, Pres. Ghent College, Ky.

Prof. Steele's unexampled success in providing for the wants of academic classes, has led me to look forward with high anticipations to his forthcoming issue.

From J. F. COOK, Pres. La Grange College, Mo.

I am pleased with the neatness of these books and the delightful diction. I have been teaching for years, and have never seen a lovelier little volume than the Astronomy.

From M. W. SMITH, Prin. of High School, Morrison, Ill.

They seem to me to be admirably adapted to the wants of a public school, containing, as they do, a sufficiently comprehensive arrangement of elementary principles to excite a healthy thirst for a more thorough knowledge of those sciences.

From J. D. BARTLEY, Prin. of High School, Concord, N. H.

They are just such books as I have looked for, viz., those of interesting style, not cumbersome and filled up with things to be omitted by the pupil, and yet sufficiently full of facts for the purpose of most scholars in these sciences in our high schools; there is nothing but what a pupil of average ability can thoroughly master.

From ALONZO NORTON LEWIS, Principal of Parker Academy, Conn.

I consider Steele's Fourteen Weeks Courses in Philosophy, Chemistry, &c., the best school-books that have been issued in this country.

As an introduction to the various branches of which they treat, and especially for that numerous class of pupils who have not the time for a more extended course, I consider them *invaluable*.

From EDWARD BROOKS, Prin. State Normal School, Millersville, Pa.

At the meeting of Normal School Principals, I presented the following resolution, which was unanimously adopted: "*Resolved*, That Steele's 14 Weeks Courses in Natural Philosophy and Astronomy, or an amount equivalent to what is contained in them, be adopted for use in the State Normal Schools of Pennsylvania." The works themselves will be adopted by at least three of the schools, and, I presume, by them all.

LITERATURE.

Cleveland's Compendiums each, \$*2 50

ENGLISH LITERATURE.

AMERICAN LITERATURE.

ENGLISH LITERATURE OF THE XIXTH CENTURY.

In these volumes are gathered the cream of the literature of the English speaking people for the school-room and the general reader. Their reputation is national. More than 125,000 copies have been sold.

Boyd's English Classics each, *1 25

MILTON'S PARADISE LOST.

THOMSON'S SEASONS.

YOUNG'S NIGHT THOUGHTS.

POLLOK'S COURSE OF TIME.

COWPER'S TASK, TABLE TALK, &c.

LORD BACON'S ESSAYS.

This series of annotated editions of great English writers, in prose and poetry, is designed for critical reading and parsing in schools. Prof. J. R. Boyd proves himself an editor of high capacity, and the works themselves need no encomium. As auxiliary to the study of Belles Lettres, etc., these works have no equal.

Pope's Essay on Man *20

Pope's Homer's Iliad *80

The metrical translation of the great poet of antiquity, and the matchless "Essay on the Nature and State of Man," by ALEXANDER POPE, afford superior exercise in literature and parsing.

Steele's Brief History of Literature, . . . 1 50

AESTHETICS.

Huntington's Manual of the Fine Arts . . *1 75

A view of the rise and progress of Art in different countries, a brief account of the most eminent masters of Art, and an analysis of the principles of Art. It is complete in itself, or may precede to advantage the critical work of Lord Kames.

Boyd's Kames' Elements of Criticism . . *1 75

The best edition of this standard work; without the study of which none may be considered proficient in the science of the Perceptions. No other study can be pursued with so marked an effect upon the taste and refinement of the pupil.

POLITICAL ECONOMY.

Champlin's Lessons on Political Economy 1 25

An improvement on previous treatises, being shorter, yet containing every thing essential, with a view of recent questions in finance, etc., which is not elsewhere found.

CLEVELAND'S COMPENDIUMS.

TESTIMONIALS.

From the New Englander.

This is the very best book of the kind we have ever examined.

From GEORGE B. EMERSON, Esq., Boston.

The Biographical Sketches are just and discriminating; the selections are admirable, and I have adopted the work as a text-book for my first class.

From PROF. MOSES COIT TYLER, of the Michigan University.

I have given your book a thorough examination, and am greatly delighted with it; and shall have great pleasure in directing the attention of my classes to a work which affords so admirable a bird's-eye view of recent "English Literature."

From the Saturday Review.

It acquaints the reader with the characteristic method, tone, and quality of all the chief notabilities of the period, and will give the careful student a better idea of the recent history of English Literature than nine educated Englishmen in ten possess.

From the Methodist Quarterly Review, New York.

This work is a transcript of the best American mind; a vehicle of the noblest American spirit. No parent who would introduce his child to a knowledge of our country's literature, and at the same time indoctrinate his heart in the purest principles, need fear to put this manual in the youthful hand.

From REV. C. PEIRCE, Principal, West Newton, Mass.

I do not believe the work is to be found from which, within the same limits, so much interesting and valuable information in regard to English writers and English literature of every age, can be obtained; and it deserves to find a place in all our high schools and academies, as well as in every private library.

From the Independent.

The work of selection and compilation—requiring a perfect familiarity with the whole range of English literature, a judgment clear and impartial, a taste at once delicate and severe, and a most sensitive regard to purity of thought or feeling—has been better accomplished in this than in any kindred volume with which we are acquainted.

From the Christian Examiner.

To form such a Compendium, good taste, fine scholarship, familiar acquaintance with English literature, unwearied industry, tact acquired by practice, an interest in the culture of the young, a regard for truth, purity, philanthropy, religion, as the highest attainment and the highest beauty,—all these were needed, and they are united in Mr. Cleveland.

CHAMPLIN'S POLITICAL ECONOMY.

From J. L. BOTHWELL, Prin. Public School No. 14, Albany, N. Y.

I have examined Champlin's Political Economy with much pleasure, and shall be pleased to put it into the hands of my pupils. In quantity and quality I think it superior to anything that I have examined.

From PRES. N. E. COBLEIGH, East Tennessee Wesleyan University.

An examination of Champlin's Political Economy has satisfied me that it is the book I want. For brevity and compactness, division of the subject, and clear statement, and for appropriateness of treatment, I consider it a better text-book than any other in the market.

From the Evening Mail, New York.

A new interest has been imparted to the science of political economy since we have been necessitated to raise such vast sums of money for the support of the government. The time, therefore, is favorable for the introduction of works like the above. This little volume of two hundred pages is intended for beginners, for the common school and academy. It is intended as a basis upon which to rear a more elaborate superstructure. There is nothing in the principles of political economy above the comprehension of average scholars, when they are clearly set forth. This seems to have been done by President Champlin in an easy and graceful manner.

ELOCUTION.

Watson's Practical Elocution \$0 25

A brief, clear, and most satisfactory treatise—same as in "Independent Fifth Reader." The subject fully illustrated by diagrams.

Zachos' Analytic Elocution 1 50

All departments of elocution—such as the analysis of the voice and the sentence, phonology, rhythm, expression, gesture, &c.—are here arranged for instruction in classes, illustrated by copious examples.

Sherwood's Self Culture 1 00

Self-culture in reading, speaking, and conversation—a very valuable treatise to those who would perfect themselves in these accomplishments.

SPEAKERS.

Northend's Little Orator, *60—Child's Speaker*60

Two little works of the same grade but different selections, containing simple and attractive pieces for children under twelve years of age.

Northend's Young Declaimer *75

Northend's National Orator *1 25

Two volumes of Prose, Poetry, and Dialogue, adapted to intermediate and grammar classes respectively.

Northend's Entertaining Dialogues *1 25

Extracts eminently adapted to cultivate the dramatic faculties, as well as entertain an audience.

Swett's Common School Speaker *1 25

Selections from recent literature.

Raymond's Patriotic Speaker *2 00

A superb compilation of modern eloquence and poetry, with original dramatic exercises. Nearly every eminent *living* orator is represented, without distinction of place or party.

COMPOSITION, &c.

Brookfield's First Book in Composition 50

Making the cultivation of this important art feasible for the smallest child. By a new method, to induce and stimulate thought.

Boyd's Composition and Rhetoric 1 50

This work furnishes all the aid that is needful or can be desired in the various departments and styles of composition, both in prose and verse.

Day's Art of Rhetoric 1 25

Noted for exactness of definition, clear limitation, and philosophical development of subject; the large share of attention given to *Invention*, as a branch of Rhetoric, and the unequalled analysis of style

MENTAL PHILOSOPHY.

Mahan's Intellectual Philosophy . . . \$1 75

The subject exhaustively considered. The author has evinced learning, candor, and independent thinking.

Mahan's Science of Logic . . . 2 00

A profound analysis of the laws of thought. The system possesses the merit of being intelligible and self consistent. In addition to the author's carefully elaborated views, it embraces results attained by the ablest minds of Great Britain, Germany, and France, in this department.

Boyd's Elements of Logic . . . 1 25

A systematic and philosophic condensation of the subject, fortified with additions from Watts, Abercrombie, Whately, &c.

Watts on the Mind . . . 50

The Improvement of the Mind, by Isaac Watts, is designed as a guide for the attainment of useful knowledge. As a text-book it is unparalleled; and the discipline it affords cannot be too highly esteemed by the educator.

M O R A L S.

Peabody's Moral Philosophy, . . . 1 25

For Colleges and High Schools.

Willard's Morals for the Young . . . *75

Lessons in conversational style to inculcate the elements of moral philosophy. The study is made attractive by narratives and engravings.

G O V E R N M E N T.

Howe's Young Citizen's Catechism . . . 75

Explaining the duties of District, Town, City, County, State, and United States Officers, with rules for parliamentary and commercial business—that which every future "sovereign" ought to know, and so few are taught.

Young's Lessons in Civil Government . . . 1 25

A comprehensive view of Government, and abstract of the laws showing the rights, duties, and responsibilities of citizens.

Mansfield's Political Manual . . . 1 25

This is a complete view of the theory and practice of the General and State Governments of the United States, designed as a text-book. The author is an esteemed and able professor of constitutional law, widely known for his sagacious utterances in matters of statecraft through the public press. Recent events teach with emphasis the vital necessity that the rising generation should comprehend the noble polity of the American government, that they may act intelligently when endowed with a voice in it.

MODERN LANGUAGE.

French and English Primer,	\$ 10
German and English Primer,	10
Spanish and English Primer,	10

The names of common objects properly illustrated and arranged in easy lessons.

Ledru's French Fables,	75
Ledru's French Grammar,	1 00
Ledru's French Reader,	1 00

The author's long experience has enabled him to present the most thoroughly practical text-books extant, in this branch. The system of pronunciation (by phonetic illustration) is original with this author, and will commend itself to all American teachers, as it enables their pupils to secure an absolutely correct pronunciation without the assistance of a native master. This feature is peculiarly valuable also to "self-taught" students. The directions for ascertaining the gender of French nouns—also a great stumbling-block—are peculiar to this work, and will be found remarkably competent to the end proposed. The criticism of teachers and the test of the school-room is invited to this excellent series, with confidence.

Worman's French Echo,	1 25
---------------------------------	------

To teach conversational French by actual practice, on an entirely new plan, which recognizes the importance of the student learning to *think* in the language which he speaks. It furnishes an extensive vocabulary of words and expressions in common use, and suffices to free the learner from the embarrassments which the peculiarities of his own tongue are likely to be to him, and to make him thoroughly familiar with the use of proper idioms.

Worman's German Echo,	1 25
---------------------------------	------

On the same plan. See Worman's German Series, page 29.

Pujol's Complete French Class-Book,	2 25
---	------

Offers, in one volume, methodically arranged, a complete French course—usually embraced in series of from five to twelve books, including the bulky and expensive Lexicon. Here are Grammar, Conversation, and choice Literature—selected from the best French authors. Each branch is thoroughly handled; and the student, having diligently completed the course as prescribed, may consider himself, without further application, *au fait* in the most polite and elegant language of modern times.

Maurice-Poitevin's Grammaire Francaise,	1 00
---	------

American schools are at last supplied with an American edition of this famous text-book. Many of our best institutions have for years been procuring it from abroad rather than forego the advantages it offers. The policy of putting students who have acquired some proficiency from the ordinary text-books, into a Grammar written in the vernacular, can not be too highly commended. It affords an opportunity for finish and review at once; while embodying abundant practice of its own rules.

Joynes' French Pronunciation,	30
---	----

Willard's Historia de los Estados Unidos,	2 00
---	------

The History of the United States, translated by Professors TORON and DE TOROES, will be found a valuable, instructive, and entertaining reading-book for Spanish classes.

Pujol's Complete French Class-Book.

TESTIMONIALS.

From PROF. ELIAS PEISSNER, Union College.

I take great pleasure in recommending Pujol and Van Norman's French Class-Book, as there is no French grammar or class-book which can be compared with it in completeness, system, clearness, and general utility.

From EDWARD NORTH, President of Hamilton College.

I have carefully examined Pujol and Van Norman's French Class-Book, and am satisfied of its superiority, for college purposes, over any other heretofore used. We shall not fail to use it with our next class in French.

From A. CURTIS, Pres't of Cincinnati Literary and Scientific Institute.

I am confident that it may be made an instrument in conveying to the student, in from six months to a year, the art of speaking and writing the French with almost native fluency and propriety.

From HIRAM ORCUTT, A. M., Prin. Glenwood and Tilden Ladies' Seminaries.

I have used Pujol's French Grammar in my two seminaries, exclusively, for more than a year, and have no hesitation in saying that I regard it the best text-book in this department extant. And my opinion is confirmed by the testimony of Prof. F. De Launay and Mademoiselle Marindin. They assure me that the book is eminently accurate and practical, as tested in the school-room.

From PROF. TIEO. F. DE FUMAT, Hebrew Educational Institute, Memphis, Tenn.

M. Pujol's French Grammar is one of the best and most practical works. The French language is chosen and elegant in style—modern and easy. It is far superior to the other French class-books in this country. The selection of the conversational part is very good, and will interest pupils; and being all completed in only one volume, it is especially desirable to have it introduced in our schools.

From PROF. JAMES H. WORMAN, Bordentown Female College, N. J.

The work is upon the same plan as the text-books for the study of French and English published in Berlin, for the study of those who have not the aid of a teacher, and these books are considered, by the first authorities, the best books. In most of our institutions, Americans teach the modern languages, and heretofore the trouble has been to give them a text-book that would dispose of the difficulties of the French pronunciation. This difficulty is successfully removed by P. and Van N., and I have every reason to believe it will soon make its way into most of our best schools.

From PROF. CHARLES S. DOD, Ann Smith Academy, Lexington, Va.

I cannot do better than to recommend "Pujol and Van Norman." For comprehensive and systematic arrangement, progressive and thorough development of all grammatical principles and idioms, with a due admixture of theoretical knowledge and practical exercise, I regard it as superior to any (other) book of the kind.

From A. A. FOESTER, Prin. Pinchurst School, Toronto, C. W.

I have great satisfaction in bearing testimony to M. Pujol's System of French Instruction, as given in his complete class-book. For clearness and comprehensiveness, adapted for all classes of pupils, I have found it superior to any other work of the kind, and have now used it for some years in my establishment with great success.

From PROF. OTTO FEDDER, Maplewood Institute, Pittsfield, Mass.

The conversational exercises will prove an immense saving of the hardest kind of labor to teachers. There is scarcely any thing more trying in the way of teaching language, than to rack your brain for short and easily intelligible bits of conversation, and to repeat them time and again with no better result than extorting at long intervals a doubting "oui," or a hesitating "non, monsieur."

For further testimony of a similar character, see special circular, and current numbers of the Educational Bulletin.

GERMAN.

A COMPLETE COURSE IN THE GERMAN.

By JAMES H. WORMAN, A. M.

Worman's Elementary German Grammar . \$1 50

Worman's Complete German Grammar . 2 00

These volumes are designed for intermediate and advanced classes respectively. The bitterness with which they have been attacked, and their extraordinary success in the face of an unprincipled opposition, are facts which have stamped them as possessing unparalleled merit.

Though following the same general method with "Otto" (that of 'Gaspary'), our author differs essentially in its application. He is more practical, more systematic, more accurate, and besides introduces a number of invaluable features which have never before been combined in a German grammar.

Among other things, it may be claimed for Prof. Worman that he has been the first to introduce in an American text-book for learning German, a system of analogy and comparison with other languages. Our best teachers are also enthusiastic about his methods of inculcating the art of speaking, of understanding the spoken language, of correct pronunciation; the sensible and convenient original classification of nouns (in four declensions), and of irregular verbs, also deserves much praise. We also note the use of heavy type to indicate etymological changes in the paradigms, and, in the exercises, the parts which specially illustrate preceding rules.

Worman's Elementary German Reader, . . 1 50

Worman's German Reader 1 75

The finest compilation of classical and standard German Literature ever offered to American students. It embraces, progressively arranged, selections from the masterpieces of Goethe, Schiller, Körner, Seume, Uhland, Freiligrath, Heine, Schlegel, Holty, Lenau, Wieland, Herder, Lessing, Kant, Fichte, Schelling, Winkelmann, Humboldt, Ranke, Raumer, Menzel, Gervinus, &c., and contains complete Goethe's "Iphigenie," Schiller's "Jungfrau;" also, for instruction in modern conversational German, Benedix's "Eigensinn."

There are besides, Biographical Sketches of each author contributing, Notes, explanatory and philological (after the text), Grammatical References to all leading grammars, as well as the editor's own, and an adequate Vocabulary.

Worman's German Echo 1 25

Consists of exercises in colloquial style entirely in the German, with an adequate vocabulary, not only of words but of idioms. The object of the system developed in this work (and its companion volume in the French) is to break up the laborious and tedious habit of *translating the thoughts*, which is the student's most effectual bar to fluent conversation, and to lead him to *think in the language in which he speaks*. As the exercises illustrate scenes in actual life, a considerable knowledge of the manners and customs of the German people is also acquired from the use of this manual.

Worman's German Grammars.

TESTIMONIALS.

From Prof. R. W. JONES, Petersburg Female College, Va.

From what I have seen of the work it is almost certain I shall introduce it into this institution.

From Prof. G. CAMPBELL, University of Minnesota.

A valuable addition to our school-books, and will find many friends, and do great good.

From Prof. O. H. P. CORPKEW, Mary Military Inst., Md.

I am better pleased with them than any I have ever taught. I have already ordered through our booksellers.

From Prof. R. S. KENDALL, Vernon Academy, Conn.

I at once put the Elementary Grammar into the hands of a class of beginners, and have used it with great satisfaction.

From Prof. D. E. HOLMES, Berlin Academy, Wis.

Worman's German works are superior. I shall use them hereafter in my German classes.

From Prof. MAGNUS BUCHHOLTZ, Hiram College, Ohio.

I have examined the Complete Grammar, and find it excellent. You may rely that it will be used here.

From Prin. THOS. W. TOBEY, Paducah Female Seminary, Ky.

The Complete German Grammar is worthy of an extensive circulation. It is admirably adapted to the class-room. I shall use it.

From Prof. ALEX. ROSENSPITZ, Houston Academy, Texas.

Bearer will take and pay for 8 dozen copies. Mr. Worman deserves the approbation and esteem of the teacher and the thanks of the student.

From Prof. G. MALMENE, Augusta Seminary, Maine.

The Complete Grammar cannot fail to give great satisfaction by the simplicity of its arrangement, and by its completeness.

From Prin. OVAL PIRKEY, Christian University, Mo.

Just such a series as is positively necessary. I do hope the author will succeed as well in the French, &c., as he has in the German.

From Prof. S. D. HILLMAN, Dickinson College, Pa.

The class have lately commenced, and my examination thus far warrants me in saying that I regard it as the best grammar for instruction in the German.

From Prin. SILAS LIVERMORE, Bloomfield Seminary, Mo.

I have found a classically and scientifically educated Prussian gentleman whom I propose to make German instructor. I have shown him both your German grammars. He has expressed his approbation of them generally.

From Prof. Z. TEST, Howland School for Young Ladies, N. Y.

I shall introduce the books. From a cursory examination I have no hesitation in pronouncing the Complete Grammar a decided improvement on the text-books at present in use in this country.

From Prof. LEWIS KISTLER, Northwestern University, Ill.

Having looked through the Complete Grammar with some care I must say that you have produced a good book; you may be awarded with this gratification—that your grammar promotes the facility of learning the German language, and of becoming acquainted with its rich literature.

From Pres. J. P. ROUS, Stockwell Collegiate Inst., Ind.

I supplied a class with the Elementary Grammar, and it gives complete satisfaction. The conversational and reading exercises are well calculated to illustrate the principles, and lead the student on an easy yet thorough course. I think the Complete Grammar equally attractive.

THE CLASSICS.

L A T I N.

Silber's Latin Course, \$1 25

The book contains an Epitome of Latin Grammar, followed by Reading Exercises, with explanatory Notes and copious References to the leading Latin Grammars, and also to the Epitome which precedes the work. Then follow a Latin-English Vocabulary and Exercises in Latin Prose Composition, being thus complete in itself, and a very suitable work to put in the hands of one about to study the language.

Searing's Virgil's Æneid, 2 25

It contains only the first six books of the Æneid. 2. A very carefully constructed Dictionary. 3. Sufficiently copious Notes. 4. Grammatical references to four leading Grammars. 5. Numerous Illustrations of the highest order. 6. A superb Map of the Mediterranean and adjacent countries. 7. Dr. S. H. Taylor's "Questions on the Æneid." 8. A Metrical Index, and an Essay on the Poetical Style. 9. A photographic *fac simile* of an early Latin M.S. 10. The text according to Jahn, but paraphrased according to Ladewig. 11. Superior mechanical execution.

Blair's Latin Pronunciation, 1 00

Hanson's Latin Prose Book, 3 00

Hanson's Latin Poetry, 3 00

Andrews & Stoddard's Latin Grammar, *1 50

Andrews' Questions on the Grammar, . *0 15

Andrews' Latin Exercises, *1 25

Andrews' Viri Romæ, *1 25

Andrews' Sallust's Jugurthine War, &c. *1 50

Andrews' Eclogues & Georgics of Virgil, *1 50

Andrews' Cæsar's Commentaries, *1 50

Andrews' Ovid's Metamorphoses, *1 25

G R E E K.

Crosby's Greek Grammar, 2 00

Crosby's Xenophon's Anabasis, 1 25

Searing's Homer's Iliad, —

M Y T H O L O G Y.

Dwight's Grecian and Roman Mythology.

School edition, \$1 25; University edition, *3 00

A knowledge of the fables of antiquity, thus presented in a systematic form, is as indispensable to the student of general literature as to him who would peruse intelligently the classical authors. The mythological allusions so frequent in literature are readily understood with such a Key as this.

SEARING'S VIRGIL.

SPECIMEN FRAGMENTS OF LETTERS.

- "I adopt it gladly."—PRIN. V. DABNEY, *Loudoun School, Va.*
- "I like Searing's Virgil."—PROF. BRISTOL, *Ripon College, Wis.*
- "Meets my desires very thoroughly."—PROF. CLARK, *Berea College, Ohio.*
- "Superior to any other edition of Virgil."—PRES. HALL, *Macon College, Mo.*
- "Shall adopt it at once."—PRIN. B. P. BAKER, *Searcy Female Institute, Ark.*
- "Your Virgil is a beauty."—PROF. W. H. DE MOTTE, *Illinois Female College.*
- "After use, I regard it the best."—PRIN. G. H. BARTON, *Rome Academy, N. Y.*
- "We like it better every day."—PRIN. R. K. BUEHLE, *Allentown Academy, Pa.*
- "I am delighted with your Virgil."—PRIN. W. T. LEONARD, *Pierce Academy, Mass.*
- "Stands well the test of class-room."—PRIN. F. A. CHASE, *Lyons Col. Inst., Iowa.*
- "I do not see how it can be improved."—PRIN. N. F. D. BROWNE, *Charl. Hall, Md.*
- "The most complete that I have seen."—PRIN. A. BROWN, *Columbus High School, Ohio.*
- "Our Professor of Language very highly approves."—SUPT. J. G. JAMES, *Texas Military Institute.*
- "It responds to a want long felt by teachers. It is beautiful and complete."—PROF. BROOKS, *University of Minnesota.*
- "The ideal edition. We want a few more classics of the same sort."—PRIN. C. F. P. BANCROFT, *Lookout Mountain Institute, Tenn.*
- "I certainly have never seen an edition so complete with important requisites for a student, nor with such fine text and general mechanical execution."—PRES. J. R. PARK, *University of Deseret, Utah.*
- "It is charming both in its design and execution. And, on the whole, I think it is the best thing of the kind that I have seen."—PROF. J. DE F. RICHARDS, *Pres. pro tem. of University of Alabama.*
- "In beauty of execution, in judicious notes, and in an adequate vocabulary, it merits all praise. I shall recommend its introduction."—PRES. J. K. PATTERSON, *Kentucky Agricultural and Mechanical College.*
- "Containing a good vocabulary and judicious notes, it will enable the industrious student to acquire an accurate knowledge of the most interesting part of Virgil's works."—PROF. J. T. DUNKLIN, *East Alabama College.*
- "It wants no element of completeness. It is by far the best classical text-book with which I am acquainted. The notes are just right. They help the student when he most needs help."—PRIN. C. A. BUNKER, *Caledonia Grammar School, Vt.*
- "I have examined Searing's Virgil with interest, and find that it more nearly meets the wants of students than that of any other edition with which I am acquainted. I am able to introduce it to some extent at once."—PRIN. J. EASTER, *East Genesee Conference Seminary.*
- "I have been wishing to get a sight of it, and it exceeds my expectations. It is a beautiful book in every respect, and bears evidence of careful and critical study. The engravings add instruction as well as interest to the work. I shall recommend it to my classes."—PRIN. CHAS. H. CHANDLER, *Glenwood Ladies' Seminary.*
- "A. S. Barnes & Co. have published an edition of the first six books of Virgil's *Aeneid*, which is superior to its predecessors in several respects. The publishers have done a good service to the cause of classical education, and the book deserves a large circulation."—PROF. GEORGE W. COLLORD, *Brooklyn Polytechnic, N. Y.*
- "My attention was called to Searing's Virgil by the fact of its containing a vocabulary which would obviate the necessity of procuring a lexicon. But use in the class-room has impressed me most favorably with the accuracy and just proportion of its notes, and the general excellence of its grammatical suggestions. The general character of the book in its paper, its typography, and its engravings is highly commendable, and the fac-simile manuscript is a valuable feature. I take great pleasure in commending the book to all who do not wish a complete edition of Virgil. It suits our short school courses admirably."—HENRY L. BOLTWOOD, *Master of Princeton High School, Ill.*

RECORDS.

Tracy's School Record, *\$0 75

Tracy's Pocket Record, *65

For keeping a simple but exact record of Attendance, Deportment, and Scholarship; containing also a Calendar, an extensive list of Topics for Compositions and Colloquies, Themes for Short Lectures, Suggestions to Young Teachers, etc.

The pocket edition is of smaller size, with blanks on the same plan, for convenience of handling, etc.

Brooks' Teacher's Register, *1 00

Presents at one view a record of Attendance, Recitations, and Deportment for the whole term.

Carter's Record and Roll-Book, *1 50

This is the most complete and convenient Record offered to the public. Besides the usual spaces for General Scholarship, Deportment, Attendance, etc., for each name and day, there is a space in red lines enclosing six minor spaces in blue for recording Recitations.

National School Diary, Per dozen, *1 00

A little book of blank forms for weekly report of the standing of each scholar, from teacher to parent. A great convenience.

REWARDS.

National School Currency, Per set, *\$1 50

A little box containing certificates in the form of Money. The most entertaining and stimulating system of school rewards. The scholar is paid for his merits and fined for his shortcomings. Of course the most faithful are the most successful in business. In this way the use and value of money and the method of keeping accounts are also taught. One box of Currency will supply a school of fifty pupils.

TACTICS.

The Boy Soldier, 75

Complete Infantry Tactics for Schools, with illustrations, for the use of those who would introduce this pleasing relaxation from the confining duties of the desk.

C H A R T S.

McKenzie's School Reading Chart, . . . \$—

Baade's Reading Case, . . . *10 00

This remarkable piece of school-room furniture is a receptacle containing a number of primary cards. By an arrangement of slides on the front, one sentence at a time is shown to the class. Twenty-eight thousand transpositions may be made, affording a variety of progressive exercises which no other piece of apparatus offers. One of its best features is, that it is so exceedingly simple as not to get out of order, while it may be operated with one finger.

Marcy's Eureka Tablet, . . . *1 50

A new system for the Alphabet, by which it may be taught without fail in nine lessons.

Scotfield's School Tablets, . . . *8 00

On Five Cards, exhibiting Ten Surfaces. These Tablets teach Orthography, Reading, Object-Lessons, Color, Form, etc.

Watson's Phonetic Tablets, . . . *8 00

Four Cards, and Eight Surfaces; teaching Pronunciation and Elocution phonetically—for class exercises.

Page's Normal Chart, . . . *3 75

The whole science of Elementary Sounds tabulated. By the author of Page's Theory and Practice of Teaching.

Clark's Grammatical Chart, . . . *3 75

Exhibits the whole Science of Language in one comprehensive diagram.

Davies' Mathematical Chart, . . . *75

Mathematics made simple to the eye.

Monteith's Reference Maps, . . . *20 00

Eight Numbers. Mounted on Rollers. Names all laid down in small type, so that to the pupil at a short distance they are Outline Maps, while they serve as *their own key* to the teacher.

Willard's Chronographers, . . . Each, *2 00

Historical. Four Numbers. Ancient Chronographer; English Chronographer; American Chronographer; Temple of Time (general). Dates and Events represented to the eye.

A P P A R A T U S.

Harrington's Geometrical Blocks, . . . *\$10 00

These patented blocks are *hinged*, so that each form can be dissected,

Steele's Chemical Apparatus, (see p.) . . *20 00

Steele's Philosophical Apparatus, (see p.) *125 00

Steele's Geological Cabinet, (see p.) . . . *40 00

Wood's Botanical Apparatus, (see p.) . . *8 00

Bock's Physiological Apparatus, . . . 175 00

THE
TEACHERS' LIBRARY.

Object Lessons—Welch *\$1 00

This is a complete exposition of the popular modern system of "object-teaching," for teachers of primary classes.

Theory and Practice of Teaching—Page . . *1 50

This volume has, without doubt, been read by two hundred thousand teachers, and its popularity remains undiminished—large editions being exhausted yearly. It was the pioneer, as it is now the patriarch of professional works for teachers.

The Graded School—Wells *1 25

The proper way to organize graded schools is here illustrated. The author has availed himself of the best elements of the several systems prevalent in Boston, New York, Philadelphia, Cincinnati, St. Louis, and other cities.

The Normal—Holbrook *1 50

Carries a working school on its visit to teachers, showing the most approved methods of teaching all the common branches, including the technicalities, explanations, demonstrations, and definitions introductory and peculiar to each branch.

The Teachers' Institute—Fowle *1 25

This is a volume of suggestions inspired by the author's experience at institutes, in the instruction of young teachers. A thousand points of interest to this class are most satisfactorily dealt with.

Schools and Schoolmasters—Dickens . . . *1 25

Appropriate selections from the writings of the great novelist.

The Metric System—Davies *1 50

Considered with reference to its general introduction, and embracing the views of John Quincy Adams and Sir John Herschel.

The Student; The Educator—Phelps . each,*1 50

The Discipline of Life—Phelps *1 75

The authoress of these works is one of the most distinguished writers on education; and they cannot fail to prove a valuable addition to the School and Teachers' Libraries, being in a high degree both interesting and instructive.

A Scientific Basis of Education—Hecker . . *2 50

Adaptation of study and classification by temperaments.

Orton's Liberal Education of Women, . . *1 50

The Teacher and the Parent—Northend . \$*1 50

A treatise upon common-school education, designed to lead teachers to view their calling in its true light, and to stimulate them to fidelity.

The Teachers' Assistant—Northend . . . \$*1 50

A natural continuation of the author's previous work, more directly calculated for daily use in the administration of school discipline and instruction.

School Government—Jewell \$*1 50

Full of advanced ideas on the subject which its title indicates. The criticisms upon current theories of punishment and schemes of administration have excited general attention and comment.

Grammatical Diagrams—Jewell \$*1 00

The diagram system of teaching grammar explained, defended, and improved. The curious in literature, the searcher for truth, those interested in new inventions, as well as the disciples of Prof. Clark, who would see their favorite theory fairly treated, all want this book. There are many who would like to be made familiar with this system before risking its use in a class. The opportunity is here afforded.

The Complete Examiner—Stone \$*1 25

Consists of a series of questions on every English branch of school and academic instruction, with reference to a given page or article of leading text-books where the answer may be found in full. Prepared to aid teachers in securing certificates, pupils in preparing for promotion, and teachers in selecting review questions.

School Amusements—Root \$*1 50

To assist teachers in making the school interesting, with hints upon the management of the school-room. Rules for military and gymnastic exercises are included. Illustrated by diagrams.

Institute Lectures on Mental and Moral Culture—Bates \$*1 50

These lectures, originally delivered before institutes, are based upon various topics of interest to the teacher. The volume is calculated to prepare the will, awaken the inquiry, and stimulate the thought of the zealous teacher.

Method of Teachers' Institutes—Bates . . . \$* 75

Sets forth the best method of conducting institutes, with a detailed account of the object, organization, plan of instruction, and true theory of education on which such instruction should be based.

History and Progress of Education . . . \$*1 50

The systems of education prevailing in all nations and ages, the gradual advance to the present time, and the bearing of the past upon the present in this regard, are worthy of the careful investigation of all concerned in

Northrop's Education Abroad, —

The National Teachers' Library.

American Education—Mansfield \$1 50

A treatise on the principles and elements of education, as practiced in this country, with ideas towards distinctive republican and Christian education.

American Institutions—De Tocqueville . . *1 50

A valuable index to the genius of our Government.

Universal Education—Mayhew *1 75

The subject is approached with the clear, keen perception of one who has observed its necessity, and realized its feasibility and expediency alike. The redeeming and elevating power of improved common schools constitutes the inspiration of the volume.

Higher Christian Education—Dwight . . *1 50

A treatise on the principles and spirit, the modes, directions, and results of all true teaching; showing that right education should appeal to every element of enthusiasm in the teacher's nature.

Oral Training Lessons—Barnard *1 00

The object of this very useful work is to furnish material for instructors to impart orally to their classes, in branches not usually taught in common schools, embracing all departments of Natural Science and much general knowledge.

Lectures on Natural History—Chadbourne * 75

Affording many themes for oral instruction in this interesting science—especially in schools where it is not pursued as a class exercise.

Outlines of Mathematical Science—Davies *1 00

A manual suggesting the best methods of presenting mathematical instruction on the part of the teacher, with that comprehensive view of the whole which is necessary to the intelligent treatment of a part, in science.

Nature & Utility of Mathematics—Davies . . *1 50

An elaborate and lucid exposition of the principles which lie at the foundation of pure mathematics, with a highly ingenious application of their results to the development of the essential idea of the different branches of the science.

Mathematical Dictionary—Davies & Peck *5 00

This cyclopædia of mathematical science defines with completeness, precision, and accuracy, every technical term, thus constituting a popular treatise on each branch, and a general view of the whole subject.

School Architecture—Barnard *2 25

Attention is here called to the vital connection between a good school-house and a good school, with plans and specifications for securing the former in the most economical and satisfactory manner.

THE SCHOOL LIBRARY.

LIBRARY OF LITERATURE.

Milton's Paradise Lost Boyd's Illustrated Ed., \$1 60

Young's Night Thoughts. . . . do. . . . 1 60

Cowper's Task, Table Talk, &c. . . . do. . . . 1 60

Thomson's Seasons do. . . . 1 60

Pollok's Course of Time, . . . do. . . . 1 60

The books are beautifully illustrated, and notes explain all doubtful meanings.

Lord Bacon's Essays (Boyd's Edition) 1 60

Another grand English classic, affording the highest example of purity in language and style.

The Iliad of Homer. Translated by POPE. . . . 80

Those who are unable to read this greatest of ancient writers in the original, should not fail to avail themselves of this metrical version.

The Poets of Connecticut—Everest 1 75

With the biographical sketches, this volume forms a complete history of the poetical literature of the State.

The Son of a Genius—Hofland 75

A juvenile classic which never wears out, and finds many interested readers in every generation of youth.

Lady Willoughby. 1 00

The diary of a wife and mother. An historical romance of the seventeenth century. At once beautiful and pathetic, entertaining and instructive.

The Rhyming Dictionary—Walker 1 25

A complete index of allowable rhymes.

True Success in Life—Palmer 1 25

Mouth of Gold—Johnson 1 00

Berard's Poems of Consolation —

Sunny Hours of Childhood 75

National School Library.

LITERATURE—Continued.

Compendium of Eng. Literature—Cleveland, \$2 50

English Literature of XIX Century . . do . . 2 50

. Compendium of American Literature do . . 2 50

Compendium of Classical Literature . do . . 2 50

Nearly one hundred and fifty thousand volumes of Prof. CLEVELAND's inimitable compendiums have been sold. Taken together they present a complete view of literature "from Homer to Holmes—from the first Greek to the latest American author." To the man who can afford but a few books these will supply the place of an extensive library. From commendations of the very highest authorities the following extracts will give some idea of the enthusiasm with which the works are regarded by scholars:

With the Bible and your volumes one might leave libraries without very painful regret.—The work cannot be found from which in the same limits so much interesting and valuable information may be obtained.—Good taste, fine scholarship, familiar acquaintance with literature, unwearied industry, tact acquired by practice, an interest in the culture of the young, and regard for truth, purity, philanthropy and religion are united in Mr. Cleveland.—A judgment clear and impartial, a taste at once delicate and severe.—The biographies are just and discriminating.—An admirable bird's eye view.—Acquaints the reader with the characteristic method, tone, and quality of each writer.—Succinct, carefully written, and wonderfully comprehensive in detail, etc., etc.

Milton's Poetical Works—Cleveland . . . 2 50

This is the very best edition of the great Poet. It includes a life of the author, notes, dissertations on each poem, a faultless text, and is the *only* edition of Milton with a complete verbal Index.

LIBRARY OF REFERENCE.

Home Cyclopædia of Chronology 3 00

An index to the sources of knowledge—a dictionary of dates.

Home Cyclopædia of Geography 3 00

A complete gazetteer of the world.

Home Cyclopædia of Useful Arts 3 00

Covering the principles and practice of modern scientific enterprise, with a record of important inventions in agriculture, architecture, domestic economy, engineering, machinery, manufactures, mining, photogenic and telegraphic art, &c., &c.

Home Cyclopædia of Literature & Fine Arts 3 00

A complete index to all terms employed in belles lettres, philosophy, theology, law, mythology, painting, music, sculpture, architecture, and all kindred arts.

LIBRARY OF TRAVEL.

Life in the Sandwich Islands—Cheever . . . \$1 50

The "heart of the Pacific, as it was and is," shows most vividly the contrast between the depth of degradation and barbarism, and the light and liberty of civilization, so rapidly realized in these islands under the humanizing influence of the Christian religion. Illustrated.

The Republic of Liberia—Stockwell, . . . 1 25

This volume treats of the geography, climate, soil, and productions of this interesting country on the coast of Africa, with a History of its early settlement. Our colored citizens especially, from whom the founders of the new State went forth, should read Mr. Stockwell's account of it. It is so arranged as to be available for a School Reader, and in colored schools is peculiarly appropriate as an instrument of education for the young. Liberia is likely to bear an important part in the future of their race.

Ancient Monasteries of the East—Curzon . 1 50

The exploration of these ancient seats of learning has thrown much light upon the researches of the historian, the philologist, and the theologian, as well as the general student of antiquity. Illustrated.

Discoveries in Babylon & Nineveh—Layard 1 75

Valuable alike for the information imparted with regard to these most interesting ruins, and the pleasant adventures and observations of the author in regions that to most men seem like Fairyland. Illustrated.

A Run Through Europe—Benedict, . . . 2 00

A work replete with instruction and interest.

St. Petersburg—Jermann . . . 1 00

Americans are less familiar with the history and social customs of the Russian people than those of any other modern civilized nation. Opportunities such as this book affords are not, therefore, to be neglected.

The Polar Regions—Osborn . . . 1 25

A thrilling and intensely interesting narrative of one of the famous expeditions in search of Sir John Franklin—unsuccessful in its main object, but adding many facts to the repertoire of science.

Thirteen Months in the Confederate Army 75

The author, a northern man conscripted into the Confederate service, and rising from the ranks by soldierly conduct to positions of responsibility, had remarkable opportunities for the acquisition of facts respecting the conduct of the Southern armies, and the policy and deeds of their leaders. He participated in many engagements, and his book is one of the most exciting narratives of adventure ever published. Mr. Stevenson takes no ground as a partizan, but views the whole subject as with the eye of a neutral—only interested in ascertaining the ends of history by the contribution of impartial facts. Illustrated.

LIBRARY OF HISTORY.

History of Europe—Alison \$2 50

A reliable and standard work, which covers with clear, connected, and complete narrative, the eventful occurrences transpiring from A. D. 1789 to 1815, being mainly a history of the career of Napoleon Bonaparte.

History of England—Berard 1 75

Combining a history of the social life of the English people with that of the civil and military transactions of the realm.

History of Rome—Ricord 1 60

Possesses all the charm of an attractive romance. The fables with which this history abounds are introduced in such away as not to deceive the inexperienced reader, while adding vastly to the interest of the work and affording a pleasing index to the genius of the Roman people. Illustrated.

The Republic of America—Willard 2 25

Universal History in Perspective—Willard 2 25

From these two comparatively brief treatises the intelligent mind may obtain a comprehensive knowledge of the history of the world in both hemispheres. Mrs. Willard's reputation as an historian is wide as the land. Illustrated.

Ecclesiastical History—Marsh 2 00

A history of the Church in all ages, with a comprehensive review of all forms of religion from the creation of the world. No other source affords, in the same compass, the information here conveyed.

History of the Ancient Hebrews—Mills . . 1 75

The record of "God's people" from the call of Abraham to the destruction of Jerusalem; gathered from sources sacred and profane.

The Mexican War—Mansfield 1 50

A history of its origin, and a detailed account of its victories; with official dispatches, the treaty of peace, and valuable tables. Illustrated.

Early History of Michigan—Sheldon . . . 1 75

A work of value and deep interest to the people of the West. Compiled under the supervision of Hon. Lewis Cass. Embellished with portraits.

LIBRARY OF BIOGRAPHY.

Life of Dr. Sam. Johnson—Boswell . . . \$2 25

This work has been before the public for seventy years, with increasing approbation. Boswell is known as "the prince of biographers."

Henry Clay's Life and Speeches—Mallory

2 vols. 4 50

This great American statesman commands the admiration, and his character and deeds solicit the study of every patriot.

Life & Services of General Scott—Mansfield 1 75

The hero of the Mexican war, who was for many years the most prominent figure in American military circles, should not be forgotten in the whirl of more recent events than those by which he signalized himself. Illustrated.

Garibaldi's Autobiography 1 50

The Italian patriot's record of his own life, translated and edited by his friend and admirer. A thrilling narrative of a romantic career. With portrait.

Lives of the Signers—Dwight 1 50

The memory of the noble men who declared our country free at the peril of their own "lives, fortunes, and sacred honor," should be embalmed in every American's heart.

Life of Sir Joshua Reynolds—Cunningham 1 50

A candid, truthful, and appreciative memoir of the great painter, with a compilation of his discourses. The volume is a text-book for artists, as well as those who would acquire the rudiments of art. With a portrait.

Prison Life 75

Interesting biographies of celebrated prisoners and martyrs, designed especially for the instruction and cultivation of youth.

LIBRARY OF NATURAL SCIENCE.

The Treasury of Knowledge \$1 25

A cyclopædia of ten thousand common things, embracing the widest range of subject-matter. Illustrated.

Ganot's Popular Physics 1 75

The elements of natural philosophy for both student and the general reader. The original work is celebrated for the magnificent character of its illustrations, all of which are literally reproduced here.

Principles of Chemistry—Porter 2 00

A work which commends itself to the amateur in science by its extreme simplicity, and careful avoidance of unnecessary detail. Illustrated.

Class-Book of Botany—Wood 3 50

Indispensable as a work of reference. Illustrated.

The Laws of Health—Jarvis 1 65

This is not an abstract *anatomy*, but all its teachings are directed to the best methods of preserving health, as inculcated by an intelligent knowledge of the structure and needs of the human body. Illustrated.

Vegetable & Animal Physiology—Hamilton 1 25

An exhaustive analysis of the conditions of life in all animate nature. Illustrated.

Elements of Zoology—Chambers 1 50

A complete view of the animal kingdom as a portion of external nature. Illustrated.

Astronography—Willard 1 00

The elements of astronomy in a compact and readable form. Illustrated.

Elements of Geology—Page 1 25

The subject presented in its two aspects of interesting and important. Illustrated.

Lectures on Natural History—Chadbourne 75

The subject is here considered in its relations to intellect, taste, health, and religion.

E

25

75

0

)

5

National School Library.

LITERATURE—Continued:

Compendium of Eng. Literature—Cleveland, \$2 50

English Literature of XIX Century . . do . . 2 50

Compendium of American Literature do . . 2 50

Compendium of Classical Literature . do . . 2 50

Nearly one hundred and fifty thousand volumes of Prof. CLEVELAND's inimitable compendiums have been sold. Taken together they present a complete view of literature "from Homer to Holmes—from the first Greek to the latest American author." To the man who can afford but a few books these will supply the place of an extensive library. From commendations of the very highest authorities the following extracts will give some idea of the enthusiasm with which the works are regarded by scholars:

With the Bible and your volumes one might leave libraries without very painful regret.—The work cannot be found from which in the same limits so much interesting and valuable information may be obtained.—Good taste, fine scholarship, familiar acquaintance with literature, unwearied industry, tact acquired by practice, an interest in the culture of the young, and regard for truth, purity, philanthropy and religion are united in Mr. Cleveland.—A judgment clear and impartial, a taste at once delicate and severe.—The biographies are just and discriminating.—An admirable bird's eye view.—Acquaints the reader with the characteristic method, tone, and quality of each writer.—Succinct, carefully written, and wonderfully comprehensive in detail, etc., etc.

Milton's Poetical Works—Cleveland . . . 2 50

This is the very best edition of the great Poet. It includes a life of the author, notes, dissertations on each poem, a faultless text, and is *the only* edition of Milton with a complete verbal index.

LIBRARY OF REFERENCE.

Home Cyclopædia of Chronology 3 00

An index to the sources of knowledge—a dictionary of dates.

Home Cyclopædia of Geography 3 00

A complete gazetteer of the world.

Home Cyclopædia of Useful Arts 3 00

Covering the principles and practice of modern scientific enterprise, with a record of important inventions in agriculture, architecture, domestic economy, engineering, machinery, manufactures, mining, photogenic and telegraphic art, &c., &c.

Home Cyclopædia of Literature & Fine Arts 3 00

A complete index to all terms employed in belles lettres, philosophy, theology, law, mythology, painting, music, sculpture, architecture, and all kindred arts.

LIBRARY OF TRAVEL.

Life in the Sandwich Islands—Cheever . . \$1 50

The "heart of the Pacific, as it was and is," shows most vividly the contrast between the depth of degradation and barbarism, and the light and liberty of civilization, so rapidly realized in these islands under the humanizing influence of the Christian religion. Illustrated.

The Republic of Liberia—Stockwell, . . . 1 25

This volume treats of the geography, climate, soil, and productions of this interesting country on the coast of Africa, with a History of its early settlement. Our colored citizens especially, from whom the founders of the new State went forth, should read Mr. Stockwell's account of it. It is so arranged as to be available for a School Reader, and in colored schools is peculiarly appropriate as an instrument of education for the young. Liberia is likely to bear an important part in the future of their race.

Ancient Monasteries of the East—Curzon . 1 50

The exploration of these ancient seats of learning has thrown much light upon the researches of the historian, the philologist, and the theologian, as well as the general student of antiquity. Illustrated.

Discoveries in Babylon & Nineveh—Layard 1 75

Valuable alike for the information imparted with regard to these most interesting ruins, and the pleasant adventures and observations of the author in regions that to most men seem like Fairyland. Illustrated.

A Run Through Europe—Benedict, . . . 2 00

A work replete with instruction and interest.

St. Petersburg—Jermann 1 00

Americans are less familiar with the history and social customs of the Russian people than those of any other modern civilized nation. Opportunities such as this book affords are not, therefore, to be neglected.

The Polar Regions—Osborn 1 25

A thrilling and intensely interesting narrative of one of the famous expeditions in search of Sir John Franklin—unsuccessful in its main object, but adding many facts to the repertoire of science.

Thirteen Months in the Confederate Army 75

The author, a northern man conscripted into the Confederate service, and rising from the ranks by soldierly conduct to positions of responsibility, had remarkable opportunities for the acquisition of facts respecting the conduct of the Southern armies, and the policy and deeds of their leaders. He participated in many engagements, and his book is one of the most exciting narratives of adventure ever published. Mr. Stevenson takes no ground as a partizan, but views the whole subject as with the eye of a neutral—only interested in unserving the ends of history by the contribution of impartial facts. Illustrated.

LIBRARY OF HISTORY.

History of Europe—Alison \$2 50

A reliable and standard work, which covers with clear, connected, and complete narrative, the eventful occurrences transpiring from A. D. 1789 to 1815, being mainly a history of the career of Napoleon Bonaparte.

History of England—Berard 1 75

Combining a history of the social life of the English people with that of the civil and military transactions of the realm.

History of Rome—Ricord 1 60

Possesses all the charm of an attractive romance. The fables with which this history abounds are introduced in such away as not to deceive the inexperienced reader, while adding vastly to the interest of the work and affording a pleasing index to the genius of the Roman people. Illustrated.

The Republic of America—Willard 2 25

Universal History in Perspective—Willard 2 25

From these two comparatively brief treatises the intelligent mind may obtain a comprehensive knowledge of the history of the world in both hemispheres. Mrs. Willard's reputation as an historian is wide as the land. Illustrated.

Ecclesiastical History—Marsh 2 00

A history of the Church in all ages, with a comprehensive review of all forms of religion from the creation of the world. No other source affords, in the same compass, the information here conveyed.

History of the Ancient Hebrews—Mills . . 1 75

The record of "God's people" from the call of Abraham to the destruction of Jerusalem; gathered from sources sacred and profane.

The Mexican War—Mansfield 1 50

A history of its origin, and a detailed account of its victories; with official dispatches, the treaty of peace, and valuable tables. Illustrated.

Early History of Michigan—Sheldon . . . 1 75

A work of value and deep interest to the people of the West. Compiled under the supervision of Hon. Lewis Cass. Embellished with portraits.

LIBRARY OF BIOGRAPHY.

Life of Dr. Sam. Johnson—Boswell . . . \$2 25

This work has been before the public for seventy years, with increasing approbation. Boswell is known as "the prince of biographers."

Henry Clay's Life and Speeches—Mallory

2 vols. 4 50

This great American statesman commands the admiration, and his character and deeds solicit the study of every patriot.

Life & Services of General Scott—Mansfield 1 75

The hero of the Mexican war, who was for many years the most prominent figure in American military circles, should not be forgotten in the whirl of more recent events than those by which he signalized himself. Illustrated.

Garibaldi's Autobiography 1 50

The Italian patriot's record of his own life, translated and edited by his friend and admirer. A thrilling narrative of a romantic career. With portrait.

Lives of the Signers—Dwight 1 50

The memory of the noble men who declared our country free at the peril of their own "lives, fortunes, and sacred honor," should be embalmed in every American's heart.

Life of Sir Joshua Reynolds—Cunningham 1 50

A candid, truthful, and appreciative memoir of the great painter, with a compilation of his discourses. The volume is a text-book for artists, as well as those who would acquire the rudiments of art. With a portrait.

Prison Life 75

Interesting biographies of celebrated prisoners and martyrs, designed especially for the instruction and cultivation of youth.

LIBRARY OF NATURAL SCIENCE.

The Treasury of Knowledge \$1 25

A cyclopædia of ten thousand common things, embracing the widest range of subject-matter. Illustrated.

Ganot's Popular Physics 1 75

The elements of natural philosophy for both student and the general reader. The original work is celebrated for the magnificent character of its illustrations, all of which are literally reproduced here.

Principles of Chemistry—Porter 2 00

A work which commends itself to the amateur in science by its extreme simplicity, and careful avoidance of unnecessary detail. Illustrated.

Class-Book of Botany—Wood 3 50

Indispensable as a work of reference. Illustrated.

The Laws of Health—Jarvis 1 65

This is not an abstract *anatomy*, but all its teachings are directed to the best methods of preserving health, as inculcated by an intelligent knowledge of the structure and needs of the human body. Illustrated.

Vegetable & Animal Physiology—Hamilton 1 25

An exhaustive analysis of the conditions of life in all animate nature. Illustrated.

Elements of Zoology—Chambers 1 50

A complete view of the animal kingdom as a portion of external nature. Illustrated.

Astronography—Willard 1 00

The elements of astronomy in a compact and readable form. Illustrated.

Elements of Geology—Page 1 25

The subject presented in its two aspects of interesting and important. Illustrated.

Lectures on Natural History—Chadbourne 75

The subject is here considered in its relations to intellect, taste, health, and religion.



Davies' Mathematics.

THE WEST POINT COURSE.

And Only Thorough and Complete Mathematical Series.

IN THREE PARTS.

I. COMMON SCHOOL COURSE.

Davies' Primary Arithmetic.—The fundamental principles displayed in Object Lessons.

Davies' Intellectual Arithmetic.—Referring all operations to the unit 1 as the only tangible basis for logical development.

Davies' Elements of Written Arithmetic.—A practical introduction to the whole subject. Theory subordinated to Practice.

Davies' Practical Arithmetic.*—The most successful combination of Theory and Practice, clear, exact, brief, and comprehensive.

II. ACADEMIC COURSE.

Davies' University Arithmetic.*—Treating the subject exhaustively as a science, in a logical series of connected propositions.

Davies' Elementary Algebra.*—A connecting link, conducting the pupil easily from arithmetical processes to abstract analysis.

Davies' University Algebra.*—For institutions desiring a more complete but not the fullest course in pure Algebra.

Davies' Practical Mathematics.—The science practically applied to the useful arts, as Drawing, Architecture, Surveying, Mechanics, etc.

Davies' Elementary Geometry.—The important principles in simple form, but with all the exactness of vigorous reasoning.

Davies' Elements of Surveying.—Re-written in 1870. The simplest and most practical presentation for youths of 12 to 16.

III. COLLEGIATE COURSE.

Davies' Bourdon's Algebra.*—Embracing Sturm's Theorem, and a most exhaustive and scholarly course.

Davies' University Algebra.*—A shorter course than Bourdon, for Institutions have less time to give the subject.

Davies' Legendre's Geometry.—Acknowledged *the only* satisfactory treatise of its grade. 300,000 copies have been sold.

Davies' Analytical Geometry and Calculus.—The shorter treatises, combined in one volume, are more available for American courses of study.

Davies' Analytical Geometry. } The original compendiums, for those desiring to give full time to each branch.

Davies' Diff. & Int. Calculus. }
Davies' Descriptive Geometry.—With application to Spherical Trigonometry, Spherical Projections, and Warped Surfaces.

Davies' Shades, Shadows, and Perspective.—A succinct exposition of the mathematical principles involved.

Davies' Science of Mathematics.—For teachers, embracing

I. GRAMMAR OF ARITHMETIC,

III. LOGIC AND UTILITY OF MATHEMATICS,

II. OUTLINES OF MATHEMATICS,

IV. MATHEMATICAL DICTIONARY.

KEYS MAY BE OBTAINED FROM THE PUBLISHERS

BY TEACHERS ONLY.

All Men, all Manners, and all Times.

**NATIONAL
SERIES.**

HISTORY.

**STANDARD
TEXT-BOOKS.**

"History is Philosophy teaching by Examples."

THE UNITED STATES.

1. **Youth's History of the UNITED STATES.** By JAMES MONTEITH, author of the National Geographical Series. An elementary work upon the catechetical plan, with Maps, Engravings, Memoriter Tables, etc. For the youngest pupils.

2. **Willard's School History**, for Grammar Schools and Academic classes. Designed to cultivate the memory, the intellect, and the taste, and to sow the seeds of virtue, by contemplation of the actions of the good and great.
3. **Willard's Unabridged History**, for higher classes pursuing a complete course. Notable for its clear arrangement and devices addressed to the eye, with a series of Progressive Maps.
4. **Summary of American History.** A skeleton of events, with all the prominent facts and dates, in fifty-three pages. May be committed to memory *verbatim*, used in review of larger volumes, or for reference simply. "A miniature of American History."

ENGLAND.

1. **Berard's School History of England**, combining an interesting history of the social life of the English people, with that of the civil and military transactions of the realm. Religion, literature, science, art, and commerce are included.
2. **Summary of English and of French History.**

FRANCE.

A series of brief statements, presenting more points of attachment for the pupil's interest and memory than a chronological table. A well-proportional outline and index to more extended reading.

ROME.

Ricord's History of Rome. A story-like epitome of this interesting and chivalrous history, profusely illustrated, with the legends and doubtful portions so introduced as not to deceive, while adding extended charm to the subject.

GENERAL.

1. **Willard's Universal History.** A vast subject so arranged and illustrated as to be less difficult to acquire or retain. Its whole substance, in fact, is summarized on one page, in a grand "Temple of Time, or Picture of Nations."
2. **General Summary of History.** Being the Summaries of American, and of English and French History, bound in one volume. The leading events in the histories of these three nations epitomized in the briefest manner.

A. S. BARNES

PUBLISHER

